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The
GEOGRAPHICAL JOURNAL

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THE KARAKORAM AND TURKISTAN EXPEDITION OF 1929-1930: *A paper read at the Evening Meeting of the Society on 23 February 1931, by*

DR. PH. C. VISSER

DIFFICULT though it may be to give in a limited space an account of an expedition which took more than one and a half years and which not only had a geographical aim, but at the same time had in view the investigation of geological, glaciological, zoological, botanical, and meteorological problems, I will nevertheless try to give in a narrow compass a synopsis of our third expedition to the mountains of Central Asia.

This time our object was first of all to explore the as yet unknown regions of the Karakoram and Saltoro-Karakoram (formerly known as Kailas-Karakoram[1]) lying in the upper course of the Shyok and Nubra rivers. In this part of the Karakoram, which differs entirely from that which we visited in 1925 in Hunza, it looks as if Nature had tried not to compress the greatest possible number of mountain ranges into the smallest possible space, as is the case in Hunza, but just to model them on a wider base, thereby leaving space between the mountains and ranges, as if to show them better. Whoever has admired a Jungfrau or Bernina, a Mont Blanc or Breithorn, will be able to understand that Matterhorns are not always required to make a landscape charming and impressive. In the Saltoro-Karakoram we found however almost perpendicular granite walls among the highest in the world, and we found mountains which need yield to none as regards beauty and majesty.

Our programme further included the exploration of the tableland, at that time still unmapped, which is situated to the east of the Karakoram Pass and the regions of the Kunlun, which confine it on the north; also observations on the borderlands of the Taklamakan desert. Not only did we intend to map out as carefully as possible the mountains which we had chosen for exploration, but also to try to find out something more about the connection of the Karakoram and Aghil mountain ranges and their continuation eastwards.

Our expedition was composed as follows: Dr. Ph. C. Visser, leader, glaciology, meteorology; Mrs. J. Visser, botany; J. A. Sillem, zoology; Dr. R. Wyss,

[1] *Note by the Editor:* This passage must not be taken as committing the Society to any opinion on a much discussed question of Himalayan nomenclature.

geology; Franz Lochmatter, mountain guide; Khan Afraz Gul Khan, surveyor; Muhammad Akram, surveyor.

Owing to the long distances which had to be covered our equipment was very voluminous, so that when leaving Leh we had to take with us not less than 445 coolie loads. We therefore made use wherever possible of base camps, the coolies generally having to cover the various stages once, twice, or three times to bring our provisions from one base camp to the other. On our marches through the high mountains we usually managed to limit the number of coolies to thirty or forty, travelling as lightly and quickly as possible.

We left Srinagar on 2 May 1929. I need not describe the much-travelled route from Srinagar to Leh *via* the Zoji La. I would however like once more to draw attention to the said pass which offers a typical example of retreating erosion, in this case of the Baltal river which runs southwards and is an affluent of the Sind river. Professor Dr. R. Oestreich gives an extensive and interesting description of this phenomenon. He also points out that nowadays the Zoji La is no longer a watershed, but that the Baltal river, lengthening its valley through the pass, now has its origin farther back, namely in Tibetan territory.

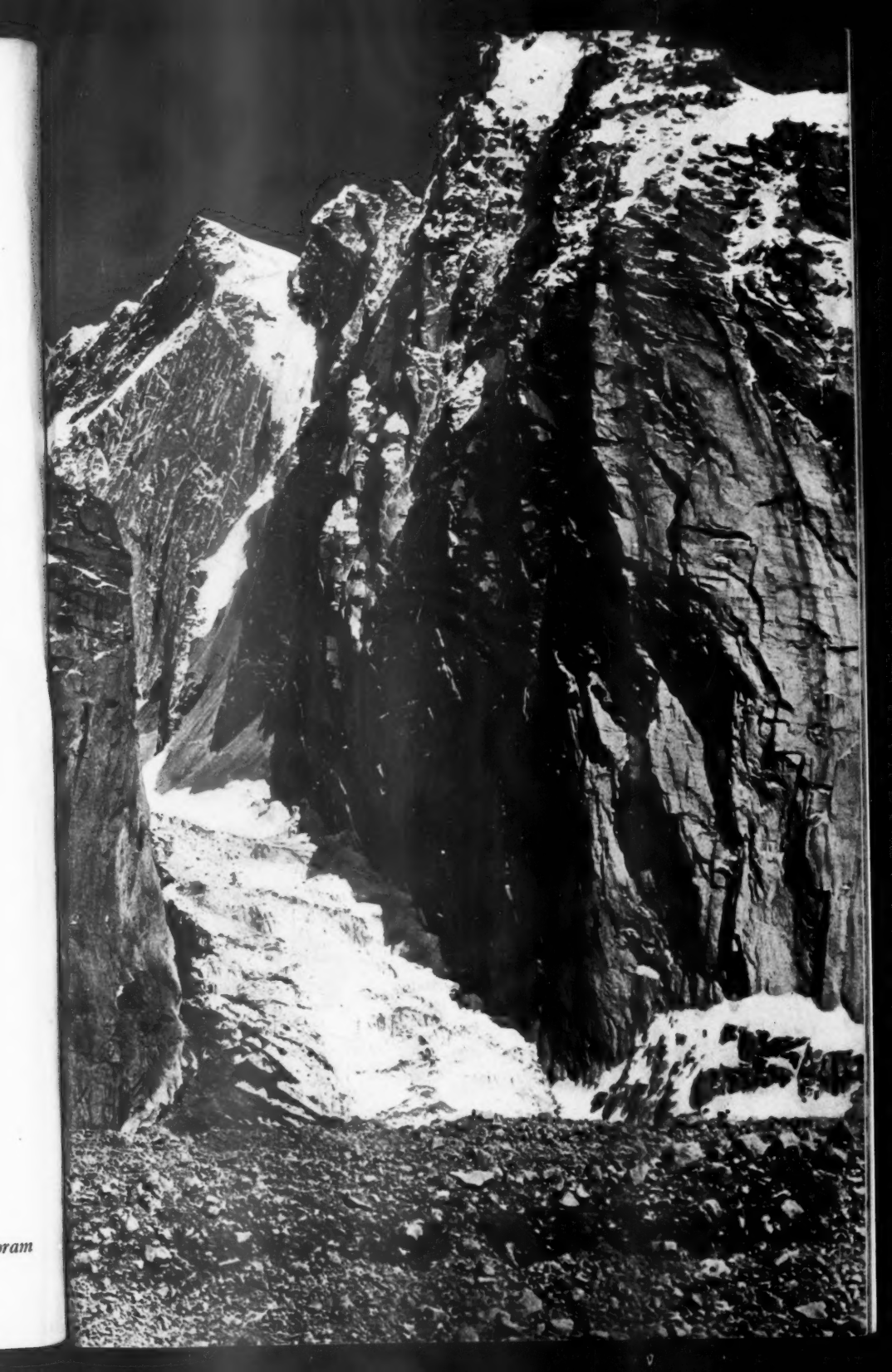
Probably there exists no mountain range forming such a striking frontier between two utterly different worlds as the Himalaya, because as soon as one has passed the Zoji La one enters into a landscape of quite a different character, with new mountain formations, with a new population, a new flora and fauna, and a new climate.

On June 2 we left Leh for the Nubra Valley, passing over the Khardung Pass, which was still covered with huge masses of snow. In Panamik we established a base camp. The first difficulty was to reach the Siachen Glacier. Owing to the big quantities of melting snow, the Nubra river rises in early summer so high that the road becomes impassable. We would however, after having finished our exploration work, have to go back by this very same road. The risk would then be considerably greater. Our first aim was the exploration of three side valleys in the Saltoro-Karakoram at the right-hand side of the Nubra Valley, for which we divided the work. Dr. Wyss and I went up the La-yoghma Valley.

The Saltoro-Karakoram need not yield in any respect to the principal chain of the Karakoram. The glacier, filling up the valley, was lying enclosed between absolutely perpendicular rock walls of dimensions such as I had never seen before (Plate 1). On the left we saw a gorge, which looked narrow in proportion to the height of the walls, but as we approached, a glacier of very normal dimensions came into view lying in it. The aspect of the chief range was also surprising, when suddenly over the curve of the glacier we saw it before us, for there rose up in the dazzling light, surpassing the keenest imagination, an obelisk of such impressive and daring build, of such harmony in lines and colours, that we were completely overpowered by it. It was a Matterhorn, the likeness of the most wonderful of Alpine peaks, but then a Matterhorn of nearly 23,000 feet. It was of a yellow brownish colour, covered with powdered snow, from its sharp point down to its foot, which sank away into an ice lake. Beside it another giant was standing, broad like a Grande Jorasse (Plate 2).

Most of the glaciers in the Saltoro-Karakoram range show the curious

Plate 1. The La-yoghma Valley, Saltoro-Karakoram



glacier type, where the firn-field, as we know it in the Alps, is completely absent. The feeding region is formed by a basin surrounded by steep rock walls, so that for the greater part the glacier is fed by avalanches. This glacier type has been very well described by Professor Oestreich and was named by him Muztagh Type. I would prefer the name Firn-basin Type.

On June 15, after numerous, often very difficult, fordings of the river and its side streams and a wearisome climb up the steep rock walls of the valley, we reached the Siachen. It is more than 46 miles long, being the second biggest glacier of Asia. We intended to explore the unknown region, which extends between this glacier and the watershed of the head chain of the Karakoram. As we did not succeed in finding a way into this region at the left-hand side of the Nubra Valley, the entrance had to be reached from the Siachen Glacier. We expected to find a side valley, filled up by a glacier, and we were quite surprised when, a few miles from the lower end of the glacier, we found a wide trough opening towards the east, in which a part of the Siachen flowed off. This glacier therefore possessed a second, though short, snout under which the broad stream of the valley disappeared. This valley was seen from the Siachen for the first time by Dr. Longstaff. It was the entrance to a majestic high mountain region with glaciers of up to nearly 16 miles in length.

Whilst Wyss and Khan Sahib climbed the Te Rong Glacier to map out its neighbourhood, Franz Lochmatter and I penetrated over the huge Shelkar Chorten Glacier into the high mountain range. We were accompanied by nine porters, stalwart men, for whom nothing was too much. They even agreed to go hungry so that we should be able to carry out our programme. The climb over the appallingly broken glacier was so difficult that we were often obliged to go by the very steep rock wall alongside the ice stream. To add to our difficulties the weather changed. It started to snow out of a dark grey fog. While we were making our way along the wall we heard all of a sudden above us something cracking and a noise of dull and heavy blows. The blows grew louder. I heard something whizzing past and saw enormous blocks flying through the air, apparently in the direction of the coolies. More blocks followed. It looked as if a granite fire had been opened on them. After the big blocks smaller stones came down, striking the rock wall. A dark cloud of dust spread like a haze. That could but mean a calamity. But to my surprise and joy I saw the coolies appearing out of the fog of snow and dust: two, four, then I counted seven, at last nine. None were missing, none were hurt. A marvellous escape.

In contrast with the glacier branch which Wyss and his party were exploring and which was lying in a deep valley, ending in steep rock walls, our glacier found its origin in a big firn field, surrounded by high snow mountains. In an eastern direction there was lying a kind of pass, so curved that the firn field, as it were, continued to the other side of the water-shed, where, as we discovered, it formed the origin of the ill-famed Chong Kumdun Glacier. This descends eastwards to the Shyok river. The ice dam blocking the valley has had disastrous consequences. From the firn field we ascended a snow peak of a height of approximately 20,350 feet. A majestic, dazzling white world was lying before us, a tremendous chaos of summits and mountain ranges stretching towards the horizon.

Plate 2. La-yoghma Glacier and the "Matterhorn" of the Saltoro-Karakoram

On our way back to Panamik we met with great difficulties owing to the water meanwhile having risen very high. We found that we could still visit the unexplored left- and right-side valleys of the Nubra Valley, so that our work fitted in completely with the explorations of our 1922 expedition (Plate 3). During our journeys through the broad Nubra Valley our attention was drawn to the distinct remnants of valley-terraces. I counted not less than seven of them, one above the other, of which the upper one was situated at about 2600 feet above the bottom of the valley.

The next object of our expedition was lying in the Karakoram valleys running eastwards, those ending in the Shyok Valley southwards of Saser Brangsa. During our journey to the Saser Pass Wyss availed himself of the opportunity to explore the only yet unknown left-hand side valley of Thalam Buti, which completed the exploration work of 1922.

In a certain sense the Saser is a curious pass. It is a long valley, filled for a great part with a glacier which, from the pass, flows away to the west as well as to the east. The highest point (17,480 feet) forms a scarcely noticeable curve in the valley.

The first side valley of the Shyok to the west led us into a grand and extensive glacier region which, especially from the glaciological point of view, gave us a rich reward. We discovered the East Chamshen Glacier, which finds its origin in the highest Saser Peak. In 1922 we had approached this same mountain from the west. The glacier was surely the most fantastic one I ever beheld. Its surface was covered with many hundreds of uniformly fashioned ice pyramids. Some of these reached a height of 150 feet. Especially towards evening time the sight of these weird ice towers was unspeakably beautiful. I will say something later on about this curious formation. Still more wonderful, almost overpowering, was the background, the enormous mountain circle from which this glacier flowed forth. Directly in front of us rose the highest Saser Peak. The summit itself attains about 25,170 feet. The wall of ice is nearly 7000 feet and reaches in one absolutely unbroken height from the glacier to the top.

We next visited a second right-hand side valley of the Shyok, to which we gave the name of Tughmo Zarpo Lungpa. It was difficult to enter the narrow gorge, and the fording of the wild mountain stream alone, although not wider than 7 feet, took us two and a half hours. It was only by throwing a rope across that we could manage to make the connection. Here again we found a mountain chain broken up into many valleys. The latter were strikingly narrow and very dangerous, owing to falling stones. Having completed the map of this part of the Karakoram we returned as soon as possible to Saser Brangsa. The danger threatened of the breaking of the dam in the Shyok Valley. A lake had formed behind the Chong Kumdun Glacier. As we learned later from Ludlow, one of the members of the special expedition sent by the British Indian Government to investigate the situation, it had a surface of not less than 65 square kilometres with a maximum depth of 122 metres. From these and other details I calculated that the capacity of the lake was about 3,750,000,000 tons.

Over the Depsang Plateau (which has been described already many times)

we travelled to Daulat-beg-öldi in order to start from there our journey into the unexplored, high mountain desert, extending eastward from the Karakoram Pass. The pony transport was sent over the Karakoram Pass to Suget Qaraul. It was in Daulat-beg-öldi that on August 16 at 5 a.m. I was awakened by a far-away noise as of thunder: heavy blows were heard in between. Khan Sahib thought the Kumdun Glacier was breaking, and, as it appeared afterwards, he was right. From a distance of 19 miles the noise had come to us over the mountains.

Through the first true right-hand side valley of the Chip-chap Valley, namely the Lung-nak Lungpa, we turned into our territory. I wrote down in my diary: "A wide valley, bounded by mountains with rounded forms. The slopes are of a light brown colour and enormous sand masses are heaped up at their feet. It looks like a mountain land in the last stage of its existence, for a great part collapsed and pulverized, weatherbeaten to sand and dust. Weary and decrepit the mountains are lying around us." No snow was to be seen. There grew no grass, no flower, no bush nor tree on this barren soil.

These Aghil mountains, eastward of the Karakoram Pass, show a very typical landscape belonging to an arid clime. Owing to the big differences in temperature during day and night a very heavy disintegration can be noticed everywhere. The finer particles of these weathered products are swept along by the storms and, especially during depressions, are set down again. But also the occasional showers of rain have brought down the weathered products from the ridges and slopes into the valleys. There are however no brooks or rivers to carry them off. Thus a continual levelling process takes place, owing to which the relative heights diminish constantly, the slopes of the mountains losing in steepness and all striking, sharp forms disappearing, until at last the landscape is formed as Hedin and others have described in the case of Tibet and as we also found it in the region mentioned above. Such regions in Tibet and surroundings are often described by the term "high plains." I prefer however the name which Drew gave to such landscapes, namely "high-level valleys." We soon had a surprise. Following the stream running through the Lung-nak Lungpa, we found after some days that this had its origin in a glacier. It was a small glacier to be sure, but a glacier all the same.

We found that our coolies after several days seemed to be suffering from the influence of the thin air at 16,500 feet and higher. Another unpleasant occurrence was the storm that regularly got up in the afternoon. It was not an ordinary storm, but a sandstorm, often so severe that the fine dust was hanging like a heavy fog in the valley, penetrating into our tents, our cases, our instruments, and even into our eyes, causing a disagreeable pain. The absence of water also made itself felt now and then.

A lonely mountain group rose in the centre of this region. The steep peaks reached to about 21,070 feet. One of these mountains was formed like a symmetrical table mountain, the others looked like the Tibetan *chortens*, the holy monuments of the Lamas, so that the coolies at once gave them the name of Chorten. As nobody would have expected snow or ice in this dried-up country we were very surprised when also in this central mountain group we discovered small glaciers. We approached this group through river-beds

which were dried up and which changed more and more into impressive canyons, with steep, terrace-formed, red-brown coloured walls.

The ascent of the highest peak now became the pinnacle of this part of our expedition in the real as well as in the figurative sense of the word. The first part of our journey took us through a very narrow gorge to the glacier. We made camp at its side at a height of about 19,000 feet. The further ascent took place along the rather steep hanging glacier to a col to the east of the peak. From there Lochmatter found much work to do, because the steep ridge, formed with an overhanging snow ridge, proved to be for a great part of hard ice, in which a few hundred steps had to be cut. Slowly but surely we climbed upwards until suddenly we could look out unhindered over the remarkable country through which we had been passing during the last few days. Far away to the south-west lay the grand white wall of the Karakoram, and in the opposite direction we saw the snow-covered mountains of the Kunlun, standing out sharply against the blue sky. That day for once the storms did not roar. There even was no wind at all. For us, Netherlands expedition members, there was still another fact which gave reason for joy, because our ascent took place on August 31, the birthday of our Queen. The highest part of the mountain was free from snow, and Wyss struck off with his hammer the very highest top. It proved to contain signs of marine fossils.

The watershed between the Chorten Thang and the Kushku Maidan is formed by a mountain chain, the Kara-tagh—Aghil, which at the northern side is covered with several small glaciers. Small though they are, one of them has a length of nearly a mile. This northern side, in spite of its greater height, gave me a strong impression of a range of dunes, such as we see from the shore of the North Sea. For a great part the melting water of the glaciers disappears immediately into the sand, so that often it was very difficult to find drinking water. The lakes which we found here, having no outlets, were salt. Especially beside such a lake, with the white, slightly curved mountains in the background, the landscape had an undeniable charm. The snowstorms, which almost regularly started every afternoon during the last week of our journey, were unpleasant, the temperature then sinking to 14° F. It was curious how difficult it proved to be to estimate distances in this country, without trees, houses, or people, which could serve as a point of comparison. Thus it happened that we stood before a lake (the Tso-rul Tso) thinking that its opposite shore was at some minutes' distance, while it actually took us more than one and three-quarter hours before we reached it.

On September 14 we hit upon something that looked like a trodden track and beside which we discovered an old camping-place. The supposition that this path led to the Kawak proved to be right. The next day indeed we reached the pass, from where suddenly the aspect opened out upon the Kunlun, one of the longest and also geologically one of the most important mountain ranges of Asia. The descent was quick, because everybody wished to get away from the bleak heights, where we had lived for more than four weeks at an altitude between 16,500 and 21,500 feet, all of us wishing to escape the bitter cold of the approaching winter, which we already experienced.

In this valley, where for the first time for fifty-four days we saw again the cheerful green of vegetation, we met some Kirghiz, who received and enter-

Plate 3. A rose-bush in the Nubra Valley

alley

Plate 4. The Sanju Kunlun from above the Sanju Pass

tained us very kindly. The settlement was lying near the Karakash Valley, through which we journeyed farther until we reached the lonely Chinese military post of Suget Qaraul.

The Sanju Pass was already under a thick layer of winter snow. On the way up we made the acquaintance of the tremendous gorges of the Kilian Kunlun. They terminated in a snow-covered rock cirque, through which a steep ice-covered zigzag path led upwards to the Sanju Pass. This pass is hardly 4 feet wide and is between steep rock walls so that one gets the impression of stepping through a gateway from one world into another. There was nearly 10° of frost, and much wind. But the sky was blue and the landscape wide and of great beauty, pure white under the fresh-fallen snow of the last days. The scenery was so attractive that Lochmatter and I followed the graceful rock crest westward of the pass to a beautiful sharp peak. The crest now and then was so narrow that I worked myself upwards sitting astride. Progress was slow, as the rocks were covered with snow and the icy wind penetrated through everything, so that hands and feet had a hard time. But once on the top our efforts were well rewarded. We sat there in the midst of a bright sky and a dazzingly pure earth. To the south were lying the giants of the Kunlun, through which like a transparent line of clouds the white mountain land could be seen which some weeks ago we had crossed. To the north the dark mountain and hill ridges of Chinese Turkistan were lying, and behind these, far away under a bluish haze, I supposed the mysterious Taklamakan Desert to be, where an old civilization lies buried under the sand, here and there brought to light by Sven Hedin, Aurel Stein, Grünwedel, Von le Coq, and others (Plate 4).

I can conveniently omit the description of our journey through Chinese Turkistan to Yarkand and Kashgar (Sillem undertook a journey to Maral-bashi). But many before us have written down already their impressions. Our chief object there was to pass the winter. Wyss profitably used his time during our stay in Yarkand for geological work, while Sillem considerably extended his zoological collections. Meteorological observations also took place regularly.

The journey from Yarkand to Kashgar and again back to Yarkand was undertaken by us in the middle of the winter. On the way back the temperature fell to —22° F. On the other hand the weather was particularly fine. Especially on the second day after our departure from Kashgar, when we rode out into the endless Taklamakan Desert, all white with snow. It was a morning of infinite light, of soft colours and transparent mists flowing together. Suddenly we saw in the west white mountain-tops, hanging like white clouds high above the horizon, floating as it were on that foggy haze, between the white earth and the bluish white sky. This was the Muztagh Range with its mountains up to 25,500 feet, which rose up to nearly 21,500 feet above the desert. Until noon this vision stayed in the sky. Then it disappeared, like a mist evaporating almost imperceptibly.

On 27 April 1930 we left Yarkand, reached Khotan after ten days, and turned from there to the west again to go through the offshoots of the Kunlun to Sanju. It was a disconsolate, deserted mountain region, barren of all life,

with nothing but sand and rocks. Through the big, wide valleys and over the almost endless high lands the wind was sighing and roaring. Like clouds the sand rose up high into the sky. Against this storm our caravan toiled, through the dried-up country, where not a drop of water was to be had.

From Sanju we followed the same route along which we had come to Alinazar Kurghan. This we made a starting-point for some explorations in the neighbourhood. Thus Wyss visited one of the unknown glacier valleys of the Kunlun chief range and the valley to the Karlik Pass, whilst I undertook the exploration of the Karakash Valley eastward of Alinazar Kurghan, at least as far as we could succeed in penetrating into the gorge. After some efforts I succeeded in finding out through a Kirghiz Chief that high over the mountains there is a path, by which one can avoid the spot where the river runs along a rock wall which descends straight into the water.

To our surprise we found a sunny, wide, and beautiful valley with patches of fresh green and arable land, with a biggish *serai* and some shepherds' huts. Some 3 miles farther on the valley bent with a sharp turn to the north. We followed the left side of the valley. On the whole the path was good. Now and then it practically stopped dead against very steep granite rocks. We then had to continue climbing until the path reappeared more clearly. The valley, surrounded by steep mountain walls, kept its character. At one moment my journey threatened to come to an untimely end, when we were forced to pass round a particularly steep rock wall by fording the river.

The second day, when in total we had marched nearly 20 miles, we reached the farthest point of our journey, where the river disappeared into a narrow cleft. We made our way back through a fertile northern side valley from where we re-entered the Karakash Valley by crossing a pass. This time we succeeded, although with much difficulty, in forcing a way along the steep walls of the valley near Alinazar Kurghan. Our intention was now to reach the Shyok Valley *via* the big caravan route and over the Karakoram Pass, in order to continue the work which we started there in 1929.

That journey was to be a series of misfortunes. From the day on which we departed from Suget Qaraul the weather changed. Rain poured down, soon turning into snow. Day after day it was weary travelling with a big caravan of ponies, mules, and donkeys over the more than 16,400-foot high Suget Pass and farther to Aq-tagh, where we hoped to find our caravan with provisions from Yarkand. On our arrival there we found no trace of our transport. The worst of all was that we had practically nothing to eat any more, neither for our servants and coolies, nor for our animals, so that we had to go back to Turkistan, in the direction of Yarkand, hoping to meet our caravan in time to save us. It was a dreary procession, which dragged itself through the barren mountain desert in which nothing was to be found. The biting cold pierced us to the marrow as we struggled against the snowstorm. In the huge snowfields our animals sank right up to their breasts. We had to drag them out ourselves and to spur on our listless pony coolies, so that at least they lent a helping hand. Thus it went on, until at last we met the eagerly awaited caravan. We at once retraced our steps, reaching, amidst continual snowstorms and piercing cold, the Karakoram Pass. This famous pass of 18,290 feet is situated among curious mountains, shaped with rounded forms.

From Murgo on we followed the way which at one time Oliver traced for the caravans, desiring to go directly through the Shyok Valley to Leh, thus avoiding the Saser Pass. This route has not proved to be of much practical use; besides, the condition in the gorge just before we reached the Shyok Valley near Kataklik was such that we could only bring our transport through it with great risk of life. It may be however that we missed the right way. Just near the Shyok Valley we met all our coolies, whom in 1929 we had sent home from Suget Karaul and who had now come to join us and enter into our service again.

In the Shyok Valley we noticed immediately a big glacier which from a side valley had shifted diagonally over the Shyok Valley and was not mentioned on any map. It had no doubt to do with an ice-flow which had made an extraordinary advance. We now divided the work again. Wyss would enter the next valley while Franz Lochmatter and I would try to explore the Sultan Chhushku Valley, that from which the above-mentioned glacier had appeared.

It was a steep, narrow valley, bounded by steep rock walls. The ice-flow formed a glacier fall, which we hoped to master in a few hours. As soon as we were on the glacier we were surrounded by gigantic ice monsters, towers, walls, and needles, which apparently stood upright in defiance of all the laws of gravity. Lochmatter cut steps to climb up and steps to get down. Or he cut holes for hands and feet along perpendicularly steep ice walls, often above bluish green glacier lakes, smooth as a mirror. Many mountain climbers consider Lochmatter to be the best ice man of the Alps; on that day he beat his own record. Hours followed hours and still we fought our way through the ice chaos. Especially for our fourteen coolies the way was extremely difficult; the more so since the mystery of the ice world with its pitiless hardness influenced their simple minds, and the rushing and roaring, the thundering and beating of the unseen water in the clefts, and the noise of the ice pinnacles crashing to pieces spoke a strange and threatening language. Even I thought the limit had been reached in this sérac wilderness, the like of which I never had seen before on my countless journeys in the Alps, Norway, Caucasus, or Karakoram. The porters followed us with incredible courage, not grumbling for a moment, with child-like trust in the strong figure of Franz Lochmatter, who inspired confidence in all. Now and then he had to shake them vigorously so that their dazed and anxious thoughts returned to the necessary work of the moment. He had to push them sometimes as he let them down with the rope along the steep ice-walls.

It became afternoon. Without taking rest we toiled on slowly, to the unceasing sound of Franz Lochmatter's ice-axe. . . . It became night. But the goal was not yet reached. Looking for a bivouac place we found a small corner between the ice pinnacles and clefts on which the tiny tents of Franz and myself could just stand. The coolies threw down their loads and began removing the stones from the ice to make the floor somewhat even. Then they helped Franz to prepare a simple meal (Plate 6).

After they also had eaten I called one of them who had a flute in his belt. He played a strange, melodious, sad tune, while all the coolies squatted round my tent. The musician played his song until darkness came and the coldness of the night had put to silence all the water-flows and streams on the ice, so that

only the mysterious music of the player was heard between the séracs. An enchanter this player was, who chased away the evil mountain spirits, carrying our coolies over the glaciers and mountains far away to the small huts in the Indus Valley, in which they lived and were happy.

At last they rolled themselves in their blankets and slept.

Hardly had twilight appeared the next morning when we were on our way again (Plate 5). Still higher the ice masses towered up around us; still more numerous were the wide clefts that forced us to take the most extraordinary roundabout ways. Still more threateningly the towers were hanging above us. Like an oppressive dream the thought haunted me, that we might be forced to go back the same way. Only late in the afternoon, under the continuous threatening of overhanging séracs, Franz let us down with the rope one after the other into a kind of *Bergschrund*, under continuous danger of falling stones, from which in nervous haste we reached a secure spot in the rocks. After more than thirty hours we had mastered the glacier fall, had succeeded in crossing the glacier, and had arrived in the heart of the high mountains, far enough to get a good view and to map out our glacier valley.

We all agreed on one point, namely that on no account would we return through the glacier fall. So that nothing else remained but to pass the ridge and to descend into the next valley, which would probably be that of Wyss. We could but hope that there we might find an easier route. The next morning at daybreak our caravan was already in the very steep couloir, through which we wished to reach the ridge. The greatest speed was necessary, before the sun would make its influence felt and the stone avalanche start. Never before had I seen our caravan climb with greater speed. Stones loosened themselves, flying closely past us. Franz cut as hard as he could, and without a single accident we reached the ridge and looked down into the next valley. With a shock I noticed that here we could not think of descending. We climbed farther along the ridge to a small peak of 17,000 feet, situated more towards the west. The tension about the question how we should find a way out relaxed a moment as we took in the beauty of this wonderful country of mountain giants.

We went on to a next gap in the ridge and from here we managed to reach the valley through steep couloirs, continually threatened by the stones, which whizzed around us. Our task was finished, for there was no doubt but we were in the glacier valley in which Wyss was working. The same evening we returned without difficulties to the Shyok Valley to descend farther in company of my wife and Sillem to the entrance of a side valley situated more to the south.

There was still one great problem which we wished to solve before the rising waters of the Shyok river prevented us from going farther, as they very soon would. We had continually hoped to be able to reach the highest Saser Peak from the south-east through one of the side valleys. The snow of its east and south slopes had to be disposed of by glaciers, and none of the two valleys which we had explored in 1929 had, even approximately, brought us into the neighbourhood, the south-east side, of the highest peak. On our way to solve this problem we were joined by Wyss, who, fully satisfied with his work, had just returned.

Plate 5. On the way up the Sultan Chhushku Glacier

lacier

We soon saw such a huge mountain stream, rushing forth from the valley which we were going to explore, that no doubt was left but that it came from a very large glacier territory. The hope was revived that we would now have a chance of solving the last big problem in these parts of the Karakoram. The second day we saw how this Shukpa Kunchang Valley divided itself into two other valleys, running more or less parallel. We decided first to explore the northern one, and after that, if possible, the southern one; if possible, because it became clear to us that it would be doubtful whether we would succeed in finding a place to ford the roaring, wide stream.

The northern valley narrowed down to an exceedingly grand gorge of enormous dimensions, above which high snow mountains sparkled. Luck was again with us, because just at the place where it proved to be impossible to continue along the true left shore, we found a thick snow bridge, lying across the stream, the remainder of a big avalanche. Along the right shore we reached, the third day after our departure from the base camp, a glacier of very big dimensions, and soon afterwards, when we had so far ascended over the ice that a free view was possible, it became clear to us that we stood on the long-expected ice stream which must have its origin in the south-east wall of the highest Saser Peak, rising up just before us although far away.

The stock of provisions would not allow of a large number of persons remaining long in this place. I therefore decided that only Wyss with a small number of coolies should carry on the exploration, while we would return to the Shyok Valley, then to go in the direction of Leh with our chief caravan. Our pony division had been sent on already.

In the Shyok Valley we learned that owing to the high water our transport had not succeeded in descending the valley along the Shyok, so that they had been obliged to return with their already over-tired animals to reach Leh by the Saser Pass and Nubra Valley, a roundabout way of about 60 miles. We too were now forced to go the same way. Even then our difficulties had not come to an end. In Panamik we were informed that the two boats which in summer are stationed near Thirit to bring the trade caravans over the Shyok had been swept away and smashed against the rocks by the flood which had occurred in consequence of the bursting of the Chong Kumdun Glacier. In order not to have to wait, perhaps for many weeks, we crossed on a raft, made of hides, while our ponies followed, swimming. Our last trial was the soft snow on the northern slopes of the Khardong Pass.

In the middle of August we reached Srinagar, soon followed by Wyss and Muhammad Akram, who had brought their work to a brilliant conclusion.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: When some two years or more ago this Society was privileged to award Dr. Visser the Back Grant he at that moment, or very close to it, was on his way to continue his investigations in the regions of the Karakoram. The award was made for the admirable work done by the expedition of which Dr. Visser was the leader, most ably seconded by Mrs. Visser and supported by that well-known surveyor, Afraz Gul Khan; a Swiss geologist, Dr. Wyss; and a country-

Plate 6. Camp on the Chhushku Glacier: cooking supper

man of Dr. Visser's, Mr. Sillem, as zoologist. To-night we are to hear of the third expedition that Dr. Visser has made to the Karakoram. He made a short expedition in 1922; in 1925 he led the Hunza expedition which I have mentioned; and thirdly, he led the expedition of which we are to hear this evening, when he surveyed and will describe to us the country between two rivers, the Nubra and the Shyok, comprising what are known as the Nubra peaks. We are eager, Dr. Visser, to hear what you have to say, an eagerness which I will interpret by asking you at once to begin your address.

Dr. Visser then read the paper printed above, and a discussion followed.

The PRESIDENT: We have with us to-night one who was in those regions some years ago, Colonel Ruck, and we should be glad if he would say a few words.

Colonel O. L. RUCK: It is interesting to note the advance and retreat of a large glacier such as the Siachen. I was up there on an ordinary shooting expedition about twenty-two years ago, and camped by the snout of the glacier. I then had with me an old map drawn up in 1862 when Ryall, of the Survey of India, sketched the lower portion of the glacier. He had marked the position of the snout at the end of the glacier, and I found when on the spot again in 1909 that the glacier had advanced, roughly, 800 yards: that is, 800 yards in about fifty years, or 16 yards a year. I have seen the wonderful map the Vissers have made, and it seems to me that since 1909 the glacier has retreated about 140 to 150 yards: that is, about 7 yards a year. So the glacier appears to be retreating at a slower rate than it advances. Major Kenneth Mason told me that the slope of the glacier bed is so easy that it has a very slow rate of advance, and of course we can understand that, but it does show, I think, that the glacier will take about another ninety years to get back to the position it occupied in 1862.

Dr. T. G. LONGSTAFF: It has been a great disappointment to me this evening that I have not already had the pleasure of reading Dr. Visser's paper; like every wise lecturer here, he has not *read* a paper, but has given a lecture, which has been most delightful and interesting. There are several of us, including Major Kenneth Mason, who is now in India, who, when the paper is published, will, I hope, find three very interesting pieces of new work described, and in country which is extremely difficult to work in.

As Dr. Visser has said very little with regard to his new work it would perhaps interest some of those present if I said a word or two about it. First of all, there is the great chain of peaks running up to over 25,000 feet between the Nubra river on the west and the Shyok river on the east, a range of mountains which is apparently the main axis of the Karakoram, about 60 miles long. Now the first to go into the snows and get up to the glaciers on the western side were Arthur Neve and Tyndale-Biscoe in 1896. They went up the Panamik valley, up on to the glaciers, and reached a height of 21,000. Then in 1909 the late Captain Morris Slingsby and I, acting on Neve's advice, went up the next valley, the Popachhe Nala, to the north-east, but we were driven out of that at only 18,000 feet by a heavy snowstorm. I think Dr. Visser used our cache of firewood in 1922. Anyhow, Dr. and Mrs. Visser visited the western side in 1922, and last year I believe they visited both the western and the eastern valleys of this range and the glaciers on the eastern side, that is west of the Shyok river, doing quite new work. When we come to the eastern side of the great Nubra-Shyok divide, the great mountains of 25,000 feet, I believe Dr. and Mrs. Visser with the other members of the party are the only people who have ever set foot on any of the glaciers on that side. Of course those glaciers had been seen from across the river; they are indicated on the old maps which Colonel Ruck referred to, but I think I know the country well enough to say that the Vissers are the

only people who have actually visited any of these remarkably difficult glaciers on the eastern slopes of the Nubra–Shyok water-parting, and I look forward with the greatest interest to reading a fuller account of them.

There was one very interesting point that amused me. You know we were all taught in school that glaciers excavate valleys, and some geologists seem to think a glacier is like a marmot and has the power of burrowing into the ground. We have seen to-night that while glaciers no doubt are able to excavate valleys in the Alps, yet in the Himalaya they make an exception to this practice; they do not excavate the valleys there because the sun is so hot that the rocky sides of the valley melt the ice of the glacier and push it back. You will realize from that photograph how utterly impossible it is for a glacier to burrow like a marmot. But I suppose I should get into trouble if I suggested that valleys excavate glaciers!

The second new piece of work done by the Vissers is the exploration of the glaciers on the western side of the upper Nubra river. They are the first people to go on to those glaciers. Thirdly, we come to the Siachen glacier, where I went with my good companions Morris Slingsby and Arthur Neve in 1909. Limited supplies combined with the utterly unknown topography deterred us from attempting to force a way down the glacier. So in the following September I followed the Nubra river up to its source, with the help of Major D. G. Oliver, British Joint Commissioner at Leh. Proceeding up the Siachen glacier from its snout I found on my right hand, that is, on the eastern or true left side of the glacier, an unexpectedly ice-free valley opening out from the range between the Siachen and Rimo glaciers (*Geogr. J.*, vol. 35, p. 644).[1]

When Major Kenneth Mason read his paper on the Shaksgam he mentioned (*Geogr. J.*, vol. 59, p. 319) that Major Gompertz surmised that there must be a large glacier beyond the head of the Mamostong glacier (Murgistang of maps) draining into the Nubra and not towards the Shyok as Neve (*Geogr. J.*, vol. 38, p. 352) had assumed in 1908. It was in reference to this that I said (*Geogr. J.*, vol. 59, p. 330) " please proceed 5 miles up the Siachen and take the first turning to the right," to settle it. It is all very well for you to laugh, but the point of my remark is that that valley has been known and pointed out for a matter of twenty years, but the Vissers are the first to go there. That work was waiting to be done. There are many people anxious to conduct exploring expeditions, but they do not always seem to take the trouble to find out what is a good place to go to. I want to point out that Dr. Visser's expedition has done a very real piece of work. I have seen a very rough unfinished map of the glaciers—they had a trained surveyor with them so there is no doubt about the map—and I can assure you that the topography as laid down on their map is wholly different from the former conception of it. So that it is really an absolutely new group of glaciers that they have discovered.

Then there is another interesting point. Dr. Visser mentioned going up the Upper Shyok to the Kumdun and Aq-tash glaciers that block the Upper Shyok valley, making an ice dam. I was privileged to see a letter Mrs. Visser wrote from India in which she said that the big lake had re-formed behind that ice dam; so that there will be another bursting of the ice dam for the newspapers next summer. The amusing part of it is that the prophets have all said in print that there will not be another flood; that the floods are finished with. But Major Mason must have been very pleased to hear the news contained in Mrs. Visser's letter because he prophesied in print that the others were all wrong: that there

[1] On turning up this reference I find a misprint in line 21, where "north-west" should read "north-east." This "empty" valley is clearly indicated on the map to face p. 744.

will be a flood. When glaciers get into the habit of advancing, as they did here two years ago, they keep that habit up for a year or two, and then they get tired of it and retire up their valleys like good marmots!

Now, fortunately for you, the lecturer comes on to ground that I do not know: the country to the east of the Karakoram between the Karakoram Pass and that great high plateau which is so little known. When we see Dr. Visser's paper and results published in the *Journal* we shall find that he has done a very great deal more than he has told us of to-night.

The PRESIDENT: I am sure we should all like to hear Mr. Amery say a word or two of appreciation.

The Rt. Hon. L. C. M. S. AMERY, M.P.: I do not know that I have anything to say and I cannot, like Dr. Longstaff, add any personal or, at any rate, recent personal knowledge of that part of the world. It is well over fifty years since I last visited the Himalaya, and such climbing as I did then was not conducted on my own feet! I have had the privilege of climbing with Dr. Visser in the Alps, and I know from reading his works and papers what a really remarkable piece of new exploration he has done. He has worked with comparatively small caravans and has concentrated on steadily opening out an unvisited and unmapped part of the world, and I think that geographers are deeply indebted to him and to Mrs. Visser for the exploration they have done. I am sure we have all admired the wonderful photographs shown us to-night. I have never seen a rock-face like that tremendous rock-face shown in one of the photographs. Certainly it has been for the ordinary spectator a thrilling evening.

H.E. THE NETHERLANDS MINISTER: Those who have had the opportunity of following the last lectures before the Royal Geographical Society will realize the pride with which I mount the platform this evening. Since last November three Dutchmen have, through the generous hospitality of the Royal Geographical Society and the genuine conception the Society has of its real purpose, been able to read papers in this hall. The first was Dr. Vening Meinesz, who gave a report of a long voyage he had made in a submarine under the sea; then came Professor Thierry, who told us about the draining and the reclamation of the Zuider Zee, on the surface of the sea. Now comes my friend Dr. Visser, who has told us what he has done at an elevation of nearly 20,000 feet over the surface. I ask you, Mr. President, am I justified in entertaining the hope that the next Dutchman I meet here will tell me of a journey to the moon?

Joking apart, I want to give Dr. Visser the assurance, in my capacity of representative of his country, of our very legitimate pride in the fact that he is a son of ours. What you have done in those climates and in those rough countries, Dr. Visser, has contributed to the prestige of your Fatherland. I thank you most heartily for what you have done for Holland and thank the Royal Geographical Society for having secured your presence this evening and you for giving yourself the trouble to cross the North Sea again. During the triumphant tour that Dr. Visser is making through the eleven provinces of Holland he has not hesitated to come over to England because I know—and we understand it—he loves England and an English audience.

We have had, thanks especially to the Royal Geographical Society, a delightful evening. We have listened to a lecture full of the liveliness which distinguishes Dr. Visser: a most delightful lecture, in very correct English, in which I dare say he has even corrected a current English expression in so far as he has proved that to give some one "a Dutch treat" can sometimes also have a pleasant meaning.

The PRESIDENT: I am under a bounden promise not to ask Mrs. Visser to say anything, and that I must abide by. I am sorry to say that Sir Francis Young-

husband was not able to be present this evening and, as we know, Major Mason is in India. It therefore falls to me to wind up the evening and, on your behalf, to offer most sincere thanks to Dr. Visser for his lecture. As I listened to the story of those great heights I realized that the mountain is like the sea, an exacting mistress, but one ever ready to give her favours to those who woo her with great devotion. That, Dr. Visser, you have done with the greatest possible success.

I am very glad that Dr. Longstaff spoke of what the results of the expedition will be, for those we have only partly heard to-night. A review of all the work that was done under Dr. Visser's leadership by Afraz Gul Khan and others in the way of real mapping and geography is yet to come, and that we can assure you, Dr. Visser, is one of the things that we regard as the most important result of your expedition. Dr. Longstaff mentioned many other things which I am sure will show you how deeply appreciative all present are of the work you have done. The fact that he mentioned it, as he very often does, in that delightful skating over thin ice, when we all hope and expect he will say something very indiscreet and he does not, adds a charm that we admire.

You may have noticed that Dr. Visser said that wherever he went he was well received. After hearing him to-night we are not surprised. May I tell him and Mrs. Visser that there is one place where they will always be well received, and that is in this country, in this Society, and in this lecture room. With that I ask you, Dr. Visser, to accept on behalf of the Society not only our very sincere thanks, but admiration both for the work you have done and the extraordinarily beautiful pictures that you have shown us this evening. I must mention that Dr. Visser has come over to lecture to us to-night, arriving at half-past five this morning; that he is returning at 10 o'clock to-morrow morning to Holland, where he will lecture the same evening. I thank you, Dr. Visser, most cordially on behalf of the whole Society.

CHANGES IN THE PHYSICAL GEOGRAPHY OF EAST AFRICA IN HUMAN TIMES: *A paper read at the Afternoon Meeting of the Society on 7 May 1934, by*

L. S. B. LEAKEY

RATHER more than three years ago, when I had the honour of addressing this Society on the subject of "East African Lakes," I gave an outline of what we then knew about the climatic changes which had taken place in East Africa in Pleistocene and recent times. One of the effects of the fluctuations of climate which I described on that occasion was a change in the levels of some of the East African lakes, and I demonstrated how the careful and detailed study of the old beach deposits and lake sediments, which now stand high and dry above the water-levels of the various lake basins, could help us to elucidate the sequence of climatic changes.

This afternoon my object is a very different one, although it will include mention and discussion of some aspects of the recorded variations of lake-level in East Africa. Since 1931 a further eighteen months of field work has been undertaken in East Africa, and many more facts concerning the problems of what I may call prehistoric geography have been discovered. I should like at this point to express my gratitude to your Society for the way in which you have so generously supported our work in East Africa, both by financial grants and by the loan of instruments. There are still, I think, a few people who would hold that it was not really one of the functions of a geographical society to support an archaeological expedition, and I have on several occasions had that view put forward to me, but not, I am glad to say, by your Society. Personally I feel that to-day, when so much of the present-day geography of the world is known, and when so few areas remain untrodden and uncharted, the trend of geographical exploration will be more and more in the direction of a study of the geography of the past, which provides a very fascinating field of exploration. I do not mean of the remote past before man was evolved, but rather of the geography of the near past when our ancestors were wandering upon the Earth. It is not sufficiently realized at present how great have been the geographical changes since the time when our ancestors and cousins first abandoned arboreal life, and with the dawning of greater mental powers started to make themselves tools and utensils and became men, real men. Everybody of course is aware of the great climatic changes which have occurred since then, but I believe that I am right in saying that very few people realize that changes of climate were not the only great changes which have occurred in human times.

For very many years now, of course, geologists have been fully aware of the geographical changes, as, for example, the cutting off of England from the continental land-mass, the elevation of the land in such a way as to leave marine beaches all round the coast-lines of Europe, and so on. Unfortunately however knowledge in the possession of geologists does not necessarily mean knowledge in the possession of the general public, whereas I believe that knowledge which is available to, or in the possession of, geographers does mean that it becomes generally known; for geography has a wider appeal and a larger public than

geology. And so, this afternoon, I propose to indicate to you some of the immense changes of physical geography which have taken place in one small part of the Earth's surface since man appeared upon the scenes, and I am going to limit myself to Kenya Colony and parts of the two neighbouring territories, Uganda and Tanganyika.

The facts that I am going to lay before you are available as a result of the work of a large number of scientists, and I can make no claim that they are all of them my own discoveries. To a very large extent they have been obtained through the co-operation of all the members of my various expeditions to East Africa, as well as through the work of other expeditions which have been engaged upon a study of the same problems in East Africa, and the members

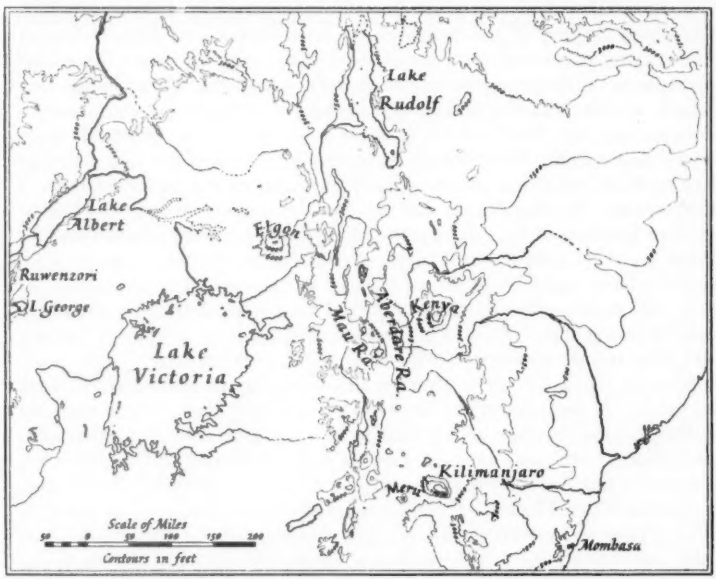


Fig. 1. Present-day physical geography of East Africa

of which have always generously co-operated in the work which we have been doing. In particular I would mention Dr. Worthington's work in this region.

In Uganda the explorations into the realms of prehistoric geography which have been carried out by Mr. E. J. Wayland, the Director of the Geological Survey, deserve very special mention, and another who has also very materially contributed to our knowledge in recent years is Dr. E. N. Nilsson, of Stockholm. All of us have worked upon the foundations laid by that great pioneer explorer of East Africa, the late Professor J. W. Gregory, whose geographical explorations covered both present-day and prehistoric geography.

Let us first of all look at the map of East Africa as it is to-day, and let me draw your attention to some of the principal physical features. Let us take the coastline first. At intervals we see islands which are mainly, but not entirely, com-

posed of coral rock. These islands are low-lying and are separated from the mainland by channels of varying depth. We shall have more to say about one of them presently, for investigations have shown that one at least, Mombasa, and probably all of them, have had a varied history from the point of view of the geographer.

Leaving the islands and coming to the mainland we find a small low-lying coastal plain of greatly varying width and usually covered with abundant tropical vegetation, and inland from this is a much more extensive sparsely watered area of what is called Nyika or bush scrub land. Following on the Nyika or bush scrub country we have an area of semi-desert country, often thickly covered with forms of vegetation which can subsist upon a very small annual rainfall, and at a corresponding altitude are the vast stretches of waterless desert country of the Northern Frontier Province of Kenya. Farther inland again, in contrast to the semi-desert bush country, we have the rolling open plains usually from 3000 to 5000 feet above sea-level. These, in the rainy season, are verdant green and abound in game of all kinds, but the greenness does not last very long, and much of the game is forced to migrate to areas which have a better water supply during many months of the year. We may link up these vast rolling plains with the grasslands on the southern fringes of the Northern Frontier deserts, and also with the country forming the North-Eastern Province of Uganda. Linked also with these rolling plains, from the point of view of altitude, are the great stretches of country which border upon Lake Victoria, especially to the north, west, and south. These areas are however very much more plentifully supplied with water than the open plains country owing to their position in relation to the vast sheet of water of the lake, which has its own system of winds and consequent rainstorms.

Next we notice the fairly extensive areas which stand from 6000 to 10,000 feet above sea-level and which are known as the Highlands. These areas are well watered and support a fairly large human population, and in parts are also well stocked with game animals. Cutting right across this highland area lies the most wonderful geographical feature of Africa, the Great Rift Valley, that great crack which runs more or less continuously from Palestine to the Zambezi River. Then we have the areas over 10,000 feet high which are cold and practically uninhabited and which really are simply the mountain masses of the country, and in isolated places over 14,000 feet, such as Mount Kenya, Kilimanjaro, and Ruwenzori, we have the eternal cold of snows and glaciers.

I have already referred to Lake Victoria. In addition to this great lake we have a number of others which lie chiefly in the two branches (the eastern and western) of the Great Rift Valley. Lake Victoria is the source of the Nile, and links up with Lake Albert. The lakes in the eastern branch of the Rift Valley are without outlet of any kind at present.

Besides the mountain masses already mentioned, which are themselves mainly of volcanic origin, there are very many other smaller volcanic hills, caldera, and craters, among which we may mention Mounts Longonot, Suswa, and Menengai. There are also mountainous regions such as the Theita Hills, which are of non-volcanic origin.

Such, very briefly, is a summary of the present-day physical geography of East Africa. With that picture in your minds I want you now to look at a map

of East Africa, reconstructed so far as we can do so on the basis of our present knowledge to show the conditions at the beginning of the Pleistocene. Let us work in the reverse order from that in which we surveyed the present-day conditions.

The areas of snow and ice were far more extensive than they are to-day. On those mountains, which still have snow and ice, the level is approximately 4000 feet lower than it is to-day, *i.e.* down to about 10,000 feet, and, in fact, all the regions which belong to our cold and uninhabitable group over 10,000 feet but less than 14,000 feet are now covered in snow and ice, as, for example, the top of the mountain masses such as Elgon. The Aberdare range, although it is over 10,000 feet high to-day, is not shown as snow capped on this map of

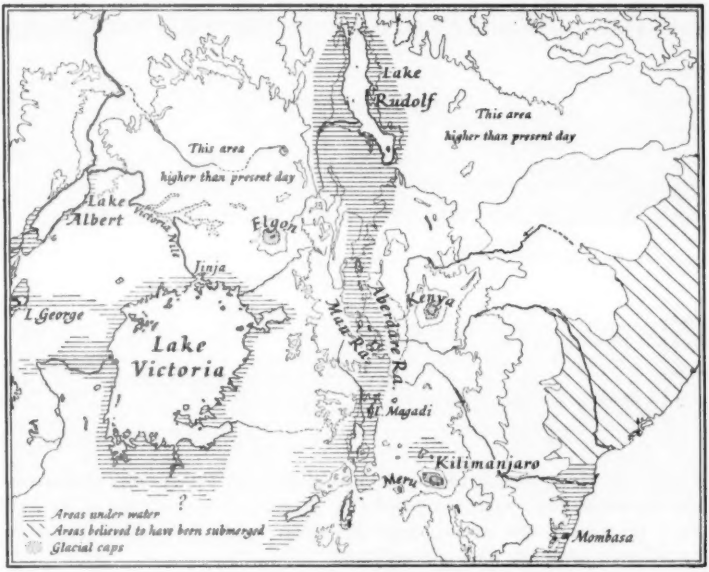


Fig. 2. Supposed Lower Pleistocene Geography

Lower Pleistocene times. This will be explained presently. The position and distribution of the ice-caps of this period have been made clear by a study of the mountain masses concerned for morainic deposits and other typical evidences of glaciers, many of which can be dated to the Lower Pleistocene with reasonable certainty, and can be found everywhere down to the 10,000-foot level. One of the almost inevitable consequences of this downward shift of the limits of permanent snow and ice, which must in large part be attributed to the general lowering of the mean temperature as well as to a great increase in precipitation, would be that the fertile and thickly populated regions of what we now call the Highlands became too cold and inclement for a permanent human population. This theoretical view is amply borne out by the absence of any traces of Stone Age culture belonging to this early period in regions over

6000 feet above sea-level, whereas cultures of later periods abound at these altitudes. This shifting downwards of the various zones means further, that what is now the open plains region with a sparse water supply, was then the most habitable region of East Africa, and once again the evidence of the relics of Stone Age man bears this out, for all the known sites of Stone Age cultures of this period lie in the region which had an altitude of about 3000 to 6000 feet above sea-level.

We must now pause to look at another aspect of the geographical problem. You will see that in this map of East Africa as it was at the beginning of the Pleistocene there is no eastern branch of the Great Rift Valley in its present form. Instead there is an immense lake running from where Lake Rudolf now lies to a point considerably to the south of Lake Magadi, and extending moreover its borders well beyond the present limits of the Great Rift Valley.

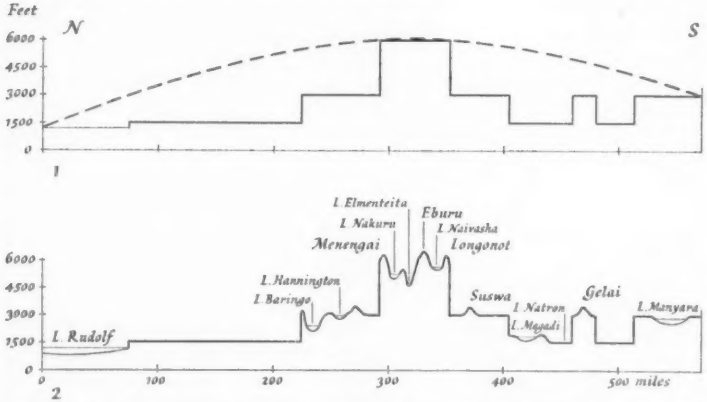


Fig. 3. (1) N.-S. section along the floor of the Rift Valley, with dotted line showing impossibility of the supposed Lake Kamasia having existed at the high level; (2) same section, showing small lake basins formed on the Rift Valley floor by volcanoes along the lines of cross-faults

That there was such a lake as this is amply testified by the immense deposits of lake silts, gravels, and diatomites which can be traced practically without interruption over this area.

But there is a big problem attached to this lake, which is at present only partially solved, and the explanation of how this lake could have existed, which is given below, must be regarded as very tentative. The study of the deposits shows clearly that there was such a lake, and also that it considerably antedated the formation of the eastern branch of the Great Rift Valley as we know it to-day, and the problem is to discover how the lake could have been where it was, or rather how its waters were held in position.

If we take a north–south section through the country formerly occupied by this lake we find that the highest ground lies more or less in the centre and that at each end the country is low-lying. Obviously the water could not possibly

Flat top of the Kinangop plateau at 8000 feet: exposure of late Kamasian fluvial lake deposits in foreground

Example of lake deposits laid down in the former great Lake Kamasia, giving evidence of its extent

Present-day snow-cap of Mount Kenya

Mount Longonot, a volcano of Middle Pleistocene age

be retained in the position in which we have shown the lake upon the map if the physical geography was the same as it is to-day. There are two possible alternative explanations of what has happened. Either we can postulate that there have been great uplift movements in the centre of the region we are dealing with, or alternatively we can suggest that there has been a very great general lowering of the levels at either end of the area. At present there is no finally conclusive evidence upon which we can settle this point, but my own view is that there has been a general uplift in the central region with perhaps some lowering of the two ends at the same time. In support of this view I would point out that: (1) the central region where I am postulating great uplift movements is also an area where great volcanic upheavals can be demonstrated to have taken place at a date later than the date of the lake; (2) the Aberdare range, which is in the central region and which now stands over 10,000 feet high, was not, so far as I can find out, covered with an ice-cap at the time when all other regions over 10,000 feet high were so covered: I therefore conclude that at this period this range had not been elevated to its present position, and that its summit was much lower than 10,000 feet; and (3) there is certain evidence from the fauna of Lake Rudolf which is more favourable to the view that the middle of the region has risen than that the two ends have sunk, for if the two ends are to be regarded as having formerly stood at about 8000 feet, and if the whole lake lay at this level, its waters would have been too cold for the tropical fish which we know lived in it. On the map therefore I have for the present indicated this prehistoric lake as lying at a fairly low level, and in order to do this I have had to lower the whole of the central region by more than 4000 feet as compared with present-day altitudes.

In addition to this great lake lying in the central region of East Africa where the eastern branch of the Great Rift Valley runs to-day you will notice that the area allotted to Lake Victoria is very much greater than at present. We have abundant evidence that the waters of the great lake stood some 300 feet above the present level, and that fact involves a much greater area of submergence. The actual beach-line has only been traced so far as isolated points here and there, on the east and west sides, but the fact that these levels are at more or less the same heights precludes the explanation that the whole basin has simply been tilted, and we must therefore argue a generally higher water-level. Next you will notice that the outlet of Lake Victoria is not shown to be where it is now, but that a series of outlets are shown to the west linking up Lake Victoria with the western lakes. I have shown an outlet from Lake Albert northward to the Nile, for I believe that at this juncture there was such an outlet at this point. This is not however certain. One of the most hopeful lines of inquiry which will enable us to be more certain about the links of these old lakes will be found one day in a study of the fossil fish remains of the old lake basins.

Having seen that there was no source of the Nile at Jinja, although alternately in another way Lake Victoria may have been one of the sources, we must turn back for a moment to the other great lake on this map, from which I have postulated an outlet somewhere in the region of the present north end of Lake Rudolf, and flowing north-westwards to the Sudan and the Nile Valley. The Lake Rudolf Rift Valley Expedition, which is now in the field under the

leadership of Mr. V. E. Fuchs and with the support of this Society, should do much to clear up this particular point. Certainly the evidence of the fauna of Lake Rudolf supports such a view, for it is a Nile fauna, although it is to-day cut off from the Nile many hundreds of miles. Certain lines of geological evidence from the Rudolf area and the Sudan also favour the idea of such an outlet.

The fact that the much greater extension of Lake Victoria was contemporary with the other great lake which has now disappeared and which we may call the Kamasian Lake or sea (using the name first given to it by the late Professor J. W. Gregory), is amply proved by the evidence both of the fauna and of the Stone Age cultures. By the edge of both these two great lakes our ancient Stone Age ancestors lived and hunted animals which have long since become extinct, and from the deposits of one of these lakes we have been able to obtain the most complete sequence of evolutionary stages of the great hand-axe culture that has ever yet been found, while in deposits of the other we found similar tools although not in such quantity, or in such complete sequence, but also the actual fossilized bones of what is probably the oldest known man yet discovered, and certainly the oldest true ancestor. That story however is not one which I can discuss this afternoon, and those who want to know more about it can find an outline of the story in a book of mine just published called 'Adam's Ancestors,' or, if they want more minute details, in a forthcoming publication called 'The Stone Age Races of Kenya.'

The co-existence of these two great lakes opens up a further problem as to where the necessary water to fill them came from. For the moment we postulate a period of greatly increased rainfall combined with a lowering of the temperature, and less evaporation.

From our present point of view the value of the faunal and cultural remains in these old deposits of the extinct great lake is that it provides a means of correlation with geographical changes in other parts of East Africa. It tells us, as we have seen, that the great extension of Lake Victoria was a contemporary happening with the existence of the lake we have called Kamasia, and also it will help us presently when we turn our attention to Mombasa Island. Much of the country which is desert or semi-desert to-day formerly bordered upon these great lakes, and was then fertile and supported large herds of animals. Fossil remains of these indicate the presence of many forest species, so that we must suppose that much of what is now waterless open plain was then thickly forested at this period.

Turning now from the interior of the country to the coast lands we find that Mombasa Island is not shown at all on my map and that a part of the coastal strip is also under water. The extent to which the inland spread of the ocean should be shown is not yet fully known. Much fuller investigations are required, but certain early Pleistocene sand deposits in this region, known as the Magiarini sands and pebble beds, contain rolled Stone Age tools. There is evidence which strongly suggests that until just before the faulting period the island and the neighbouring coast-line were beneath the sea, and there is very definite evidence of faulting at a much later period than that which we are at present examining.

Now let us take another map, this time depicting the state of the physical

geography at the end of the Middle Pleistocene period, after the faulting of the eastern branch of the Great Rift Valley has occurred. The snow-line on the mountains is now at a very much higher level, but not so high as it is to-day, and mountains like Mount Elgon still have a glacial cap. The Aberdare range, which by now has been uplifted to its present-day height, has a snow-cap and small glaciers on its highest summits. The eastern branch of the Great Rift Valley has been formed by a series of block faults. Running across the valley, along the transverse fault-lines, great volcanic eruptions have built up mountains such as Eburu, Longonot, Suswa, etc., as well as giant caldera such as Menengai, and these, together with many small subsidiary volcanoes, have had the effect of dividing up the length of the Great Rift into a number of

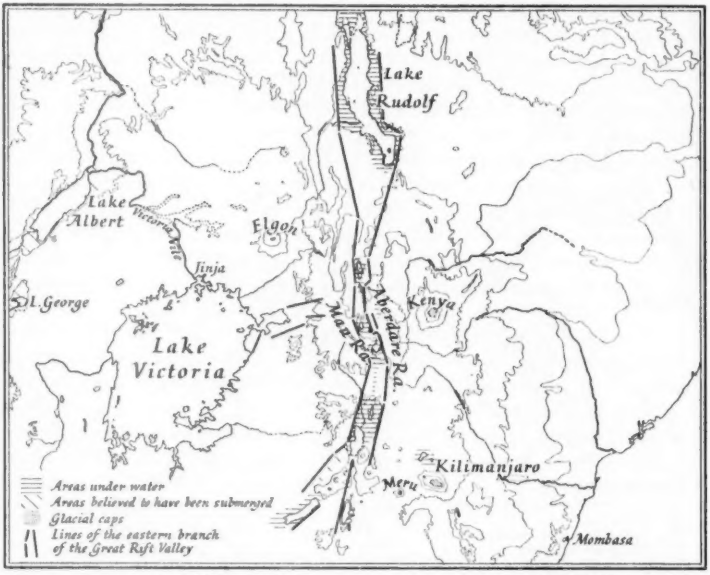


Fig. 4. Supposed Middle Pleistocene Geography after the Rift Valley faulting

smaller basins. Owing to the fact that only the centre of the area has been uplifted and that there has been block faulting along the whole length, the north–south section along the floor of the Rift Valley is that which is seen in the diagram. But for the volcanic upheavals, which have thrown dams across the valley, no new lakes could have formed in the greater part of the valley. As it is we find on looking at the map that there is a chain of lakes, which incidentally are much bigger than those of the present day, running all along the line of the Rift Valley. The biggest of these lie at the north and south ends of the area, which we are examining, which is only natural seeing that they are low-lying lakes with much greater watersheds. From the evidence of the fish and other faunas it seems clear that the northern member of the chain of lakes, Lake Rudolf, owed its first waters to the remaining waters of the earlier great lake,

and this was also probably true of at least the bigger of the other line of lakes. Only so can their fish and mollusc fauna be explained. A very great deal of further investigation into the fossil fish faunas of the lakes of this period, as well as of the living fish of the southern group of lakes, is required.

Turning from the eastern branch of the Great Rift we find that by now Lake Victoria has been reduced very much to its present proportions, and that the source of the Nile at Jinja has come into existence. This is due in part to actual faulting, and in part to the general lowering of the country to the north of Lake Victoria, apparently in compensation for the uplifting that was going on more to the east, and which we have already seen. Among other changes of physical geography which have taken place now in this region we must take into account

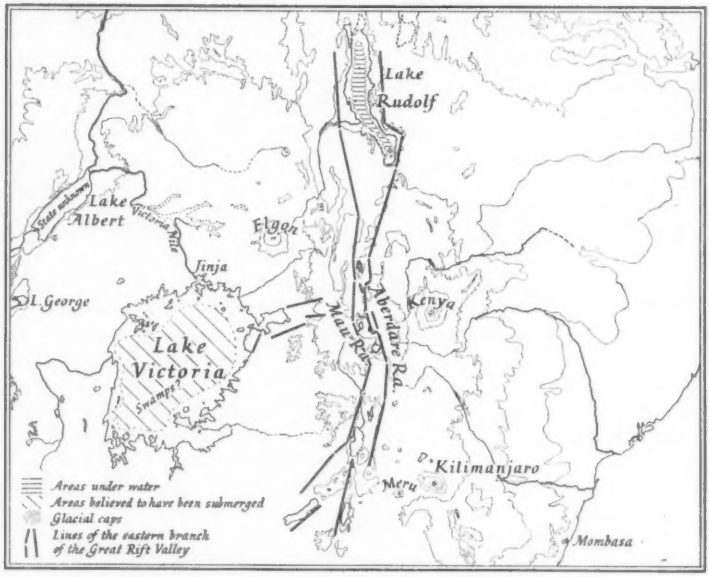


Fig. 5. Supposed Late Upper Pleistocene Geography

the complete reversal of some of the river systems on the western side of Lake Victoria. Mr. E. J. Wayland has made an extensive study of these, and when his detailed account of them is published we shall have a great deal of new information concerning geographical changes in that region.

Turning from the west to the coast we now find that the piece of land which has to-day become Mombasa Island is standing well above sea-level, and that it is joined to the mainland, instead of being separated from it as it is to-day. It is also of larger size. Living on it at this time were Stone Age men, who obtained most of the raw material for their tools from what is now the mainland.

We must now miss another long period of time and take a brief look at the map towards the end of the Pleistocene period, and we find ourselves confronted

with a different geographical condition again. East Africa was then suffering from a period of greatly decreased rainfall, and large areas which to-day have a good climate were then much drier. On the mountains the snow-caps have dwindled to mere nothings, or have disappeared altogether. Some of the lakes which formerly existed in the Rift Valley have disappeared altogether, others have shrunk till they are mere dwarfs in comparison with what they looked like at the end of the Middle Pleistocene, and they are much smaller than they are to-day. Even Lake Victoria has been very considerably reduced in size, and so far as can be estimated the outflow at Jinja probably ceased to flow altogether. Islands which are cut off from the mainland to-day were joined to it, and became inhabited by animals of the same kind as those on the mainland to-day, and Stone Age man was also able to get access to them. Large areas of the country were desert, and man and animals seem to have congregated near the lakes which did not dry right up and also in the high lands near the mountains. The island of Mombasa was still joined to the mainland, for we find that desert sands were able to be blown on to it and accumulate there. The experience of areas such as the Nile Valley and the Vaal River in South Africa shows that deposition of wind-blown sands would have been arrested by a stretch of water such as that which to-day separates the island from the mainland.

After this period of desert conditions the physical geography of East Africa attained very much its present form, save only that for a long time climate was definitely wetter than it is to-day, so that the lakes which lie in enclosed basins were larger and that the areas which are now desert were mostly if not all habitable.

I should like in closing to emphasize that the outline which I have given of the changes in the physical geography of East Africa must only be considered as very general. A vast field of study awaits detailed investigation; but I believe that the available evidence justifies the presentation of a generalized picture. I myself intend to continue investigations into the prehistoric geography of East Africa, and I very much hope that this fascinating field of geographical exploration will attract more and more workers both in that region and elsewhere in the world.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: As you know, we are going to be addressed by Dr. Leakey upon the changes in physical geography in East Africa in human times. Dr. Leakey has spent a great many years of his life in East Africa and has been on numerous expeditions, mainly with what may be called archaeological ends in view. But there is an archaeological aspect to geography which geography cannot ignore, and it is of great interest to us as a Geographical Society to hear evidences and views, inevitably speculative, as to the geographical features of the Earth's surface and the creatures which inhabited various regions in early human times.

Dr. Leakey is going to talk to us this afternoon about "human" times when man first appeared, and he is going to deal with the region covered by Uganda, Kenya, and Tanganyika: an extraordinarily interesting region, including a piece of the famous Rift Valley. As he will tell us, many of the views that he and others may put forward must necessarily be speculative at present, but there is a great deal left for intensive inquiry to elucidate.

Dr. Leakey then read the paper printed above, and a discussion followed.

The PRESIDENT: Dr. Worthington, would you comment on the paper? Dr. Worthington was a Balfour student of zoology, and has already read a paper before the Society.

Dr. E. B. WORTHINGTON: Dr. Leakey has built for us a very fine Aunt Sally, and I feel that by building it he is sacrificing himself for the purpose of scientific advancement, which is a very worthy thing to do. There is no doubt that many of the postulates he has put forward this afternoon are going to be proved wrong, but by putting forward his ideas he is giving those working in different fields something to throw stones at and something to build upon. I do not want to throw many stones at the moment because I feel that in certain respects I am responsible for building up the target, but there are one or two comments I would like to make.

Firstly, I feel that the whole question wants examining by somebody with a deep knowledge of physical science, especially meteorology. In his figure Dr. Leakey showed us an enormous lake extending the whole length and width of the Rift Valley, and outside it as well: an area of water which, even under reduced evaporation, must have lost a very great deal every year. Now the drainage basin shown in that figure is, I feel, in no way sufficient to fill that enormous area of Rift Valley with water. I suggest that some geographer versed in physical science could work out the area of drainage basin which would be required to fill such a lake under different rainfall and evaporation rates.

Towards the end of his paper Dr. Leakey showed a map of Lake Victoria during the arid interpluvial period about half its present size. I want to halve the half-size that he showed—in fact, to reduce the whole of Lake Victoria during that dry period to practically nothing but a swamp. There is a deal of faunistic evidence for this which I will not bother you with at the moment. I will merely mention that the suggestion is based on the fact that most of the fish which are typical of the whole of the lower Nile system are absent from Lake Victoria to-day. Instead of those fish Lake Victoria is peopled by an enormous number of charming little highly coloured fish, mostly about 6 inches in length, which are found nowhere else in the world. They have come into being during the process of evolution in the lake itself, and they have never got out of it. Something had to get rid of the original fauna which we know was there, and the drying up of the lake seems much the most reasonable explanation. It need not have become bone dry, because the fish which have disappeared all require well-aerated water and cannot exist in swampy conditions. This is further confirmed by the fact that there are a few of the typical African fish still living in Lake Victoria, the cat-fish and the lung-fish, which are well known to be able to bury themselves in mud and resist drought for quite a number of years. I suggest that those air-breathing fish succeeded in carrying over the dreadful period of drought when the whole of Lake Victoria was reduced to swamps.

The next faunistic point is in connection with Lake Rudolf, whose fauna is utterly different. It has almost the whole outfit of typical African fish, and therefore supports the postulate of a Kamasian lake. Although Lake Rudolf may have been isolated just as long as Lake Victoria has been, yet there is not a huge abundance of endemic fish (fish evolved there and found nowhere else). At first sight this seems all wrong, and the whole idea appears to break down. But if one compares the processes of life (*i.e.* the ecology) in Lake Rudolf and Lake Victoria, the anomaly is easily explained. In Lake Rudolf there are the great Nile perch, the tiger fish, and other predatory fish, whereas Lake Victoria does not contain those predators. As a consequence, in Lake Victoria little fish evolve, become different, turn into new species, and since there is nothing to eat them, they live.

In Lake Rudolf natural selection is very much more violent, and any little new fish that becomes evolved is immediately gobbled up by tiger fish or Nile perch. This shows that one cannot simply think about the distribution, the numbers of creatures or fossils in one place compared to another, but that one has to consider the ecology at the same time.

From the faunistic point of view I think the chief objection to the enormous size of the Kamasian lake is the fact that we have no evidence of the fish which inhabited the southern end of it, in the region of Lake Natron, Lake Eyassi, and Lake Manyara. In view of the great importance of this subject, not only to geology and prehistory, but also to zoology, we very much want to have a complete collection of the living and fossil fauna from that region. Dr. Leakey is proposing to go out there next year to collect fossils. I also sincerely hope to get into the field again before long. If it cannot be managed next year I hope Dr. Leakey will bring back as many of the living creatures from those lakes as he possibly can.

The PRESIDENT: Mr. Hobley is a geologist who has been many years in the region we are discussing.

Mr. HOBLEY: Dr. Leakey's accomplishments are very varied and widespread. I have only to refer to the fact that a few weeks ago I was present at a lecture at which he entertained us all by a most lucid account of Kikuyu folk-lore. I think to-day's paper is a very stimulating effort on his part. I do not agree with some of it, but that is to be expected: perhaps it is due to the incompleteness of my knowledge, but there are certain points on which I join issue with him. I rather deprecate the question of geography *versus* geology. For some reason Dr. Leakey appears to think that geologists are always obscure and that therefore their pronouncements are unintelligible to the general public. I do not know whether that is quite true, but of course it is possible that the geologist may be a little more cautious in his pronouncements. However that may be, I do seriously welcome the greater increase of geological information which has during recent years appeared in the lectures in this Hall and in the *Journal* of the Society. It shows that geographers are more and more taking the trouble to realize the importance of the rocks which they walk over: it is a very good sign.

With regard to the lecture, one of the main points is the enormous Pleistocene Kamasian lake. If you can recall the map Dr. Leakey showed you will remember that this lake had more or less parallel sides, and like all lakes, it must have lain in a valley. Dr. Leakey states that the existence of this lake was proved by deposits which can be traced practically without interruption along its length, and further that it anteceded the Rift Valley as we know it. I doubt if the lake deposits he refers to do occur without interruption along the course of his hypothetical lake, and moreover the depression in which such a long lake lay must have been the beginning of a rift valley, that is to say, a long depressed area bounded by faults.

The width of the present rift is from 20 to 30 miles, and if so recently there was a great lake 100 miles wide there would probably be boundary faults 100 miles apart. I am inclined to think that there is little trace of this extra width although some of the present lakes were once larger than now. Then again, as Dr. Worthington has pointed out, it is very difficult to visualize the drainage of an area sufficient to fill this great lake. It may of course have been a pluvial period and drainage from outside may not have been so essential. I am however dissatisfied with the drainage question in regard to this colossal lake.

Dr. Leakey has further postulated an enormous rise of general level over a huge stretch of country; this hypothetical lofty plateau is then supposed within a short period to have been lowered some 4000 feet or more. I would however

like to assure you that geologists are cautious folk and do not lightly postulate rises and falls of 4000–5000 feet in continents during the Pleistocene period.

The generally accepted theory regarding Lake Victoria is that in pre-Rift times the rivers on the east side of the present lake flowed westwards across its present site, thus forming part of the Congo River system. The great fracture known as the western rift occurred, the outlet to the Congo was blocked, a depression was presently formed where Lake Victoria now is, and the drainage between the east side of the western rift and the Lake Victoria basin was reversed. Where the outlet of the old Lake Victoria was is difficult to prove: the lecturer thinks it drained west, but if the drainage was once reversed as stated above it is unlikely that another and only temporary reversal took place. I assume that it always had an outlet, for the waters are fresh and there are no traces of saline deposits. I would rather incline to look for an exit to the north and suggest the valley of Assua River, a tributary of the Nile which joins it near Nimule. The Assua has, I believe, an old-looking valley cut through metamorphic rocks.

With regard to the question of Mombasa the physiography of this region does not, I submit, offer any great problem, and I would suggest that the author leaves the coast out of the discussion, for probably the tectonics of this region are but remotely connected with those of the rifts. There have been along the coast fairly recent variations of level of the order of about 100 feet, and Mombasa to-day is hardly an island. At one place, at low tide you can walk across from the mainland to the island and the water only covers your ankles, so a very slight oscillation of level would join the island to the mainland and remove all the difficulties regarding the blown sand stated to be found thereon.

Mombasa Island is, as you know, tucked away into the general outline of the East African coast. Bounding it there are two main channels, one north and one south, the former leading up into valleys to the north-west and the latter, a more important one, leading up into a striking valley which as one proceeds west is found to have cut its way through the Shimba Range. These valleys were cut, or at any rate much deepened, during a pluvial period when the rivers had considerable erosive force. In the last mile of their course they pass through deep channels in the coral. These passages are, it is believed, not due to erosion but to the inhibition of the growth of the coral by a large volume of fresh water. There were several oscillations of level either in water or land, for at certain places there are signs of drowned valleys; there is a well-marked one opposite Kilindini. I say oscillations of relative level between the sea and land, for we are not sure that the sea-level has been constant: some postulate a considerable rise of sea-level at the termination of the Ice Age.

In conclusion I should like to say that there are so many points in this paper capable of varying interpretations that one could review it better on paper than in debate, but when published it should prove a stimulus to all who are interested in the geological history of East Africa. I hope that the next time Dr. Leakey goes out there he will further study these problems and will be able to return and to convince us that some of his theories are not quite what he thought they were.

The PRESIDENT: Mr. Sikes, will you kindly comment on the paper? Mr. Sikes is an official from Kenya, Director of Public Works.

Mr. H. L. SIKES: As I have spent about twenty-five years in Kenya Colony, and during that period have taken much interest in the geology and geography of that territory, I have listened to Dr. Leakey's lecture with the utmost interest. I have had the privilege in the past of accompanying him and seeing some of his sites, his archaeological specimens, and so forth, and I also had the privilege of accompanying the late Dr. Gregory on his tour during 1919.

There is a good deal in what Dr. Leakey has said with which I find myself in

sympathy; with some I find myself in agreement. But there is much which I regard as being highly conjectural, and I think, as he has said, we require a good deal more evidence before we can accept some of his views or hypotheses. I feel, like Dr. Worthington, that evidence of the existence of a continuous lake along the Rift Valley in Kamasian time is very inadequate at present. I feel more inclined to the view that there was a series of lakes during that time in the Rift Valley. Doubtless the topography of the country was different from now, but the evidence seems to me to point to such a succession of lakes at various elevations and connected by rivers at that period as there was during the second pluvial in Upper Pleistocene time.

I think one of the chief points which Dr. Leakey has proved from his investigations is that Dr. Gregory's Nyasan, or Kamasian, series of lake sediments must be moved up from mid-Tertiary to about mid-Pleistocene or, at any rate, the upper part of that series; for Dr. Oswald's deposits at Karungu on Lake Victoria, and probably others, must still be ascribed to the Miocene or Pliocene. Another point which I would like to stress is that Dr. Leakey's Gamblian and Makalian deposits in the Rift Valley are divisions of the Upper Pleistocene and post-Pleistocene series which Gregory called the deposits of Lake Suess. He desired to associate the great name of Professor Suess with those sediments and the lakes which gave rise to them, and I think we should not lose sight of that name.

Dr. LEAKEY: I am very glad that those who have spoken have all stressed the need for further light on the problems I have discussed. It is exactly what I wanted to bring to your attention. I said at the beginning, and say again, that the point that stands out is that we have evidence of great changes of geography, and we have some evidence that we cannot explain. In particular about Lake Kamasia; there are deposits, sometimes over 1000 feet thick, attributable to this lake. We can trace them in exposures along the Rift Valley for mile upon mile. I cannot explain them, or where the water came from for such an immense lake. I postulate, at the moment, a great increase of rainfall, possibly up to something like 200 or 300 inches a year. That is the only possible explanation that I can see. The deposits are there, and we have not yet found any other means of explaining them. I hope others will be stimulated to further research along other lines.

The question of the fauna is another which I want to stress. Zoological work is absolutely essential to the study of prehistoric geography. I know there is a tendency towards specialization, but in the old days one man had to have a knowledge of a number of scientific subjects. I hold that to-day it is necessary, if you desire to do good work in the field, to have more than just a special knowledge of one subject. If you have not yourself knowledge of more than one special branch of science, then your work must be carried out in co-operation with other specialists; you must have, as it were, one head with a number of bodies, or one body with a number of heads. At any rate, co-operation between zoologists, meteorologists, the geographer, and the pre-historian is very necessary indeed, and this method is becoming more and more adopted in use. I hope expeditions organized in the future will increasingly try to include members of different scientific branches.

The question raised by Mr. Hobley as to my postulate of a great rise in the region of what is now the Aberdares and the Mau, a rise of over 4000 feet in general land-level, is not as difficult as he thinks. There is a good deal of evidence being put forward by geologists for exactly the same sort of movement about the same time—the Middle Pleistocene. Professor De Terra, working in the Himalayan region, has shown reasons for believing that in the Middle Pleistocene there was an uplift movement over an enormous region of about 4000 feet, and

in the Geological Section of the British Association Meeting last year when I was speaking of this same problem to the geologists, two geologists from different parts of the world got up and said they themselves had evidence, one in Java, one in India, of movements of at least 4000 feet in the Mid-Pleistocene. Therefore my postulate of such a movement in East Africa is not out of keeping with evidence in other parts of the world at the same time. As far as I can see it is the only way in which we can explain the facts we have to account for.

As to Mombasa and its relation to the mainland, I think the fact that the channel is still a very shallow one shows that the channel is not very old. I cannot go into the evidence here, but I have much evidence to show that Mombasa was completely linked to the mainland until comparatively recently.

There were innumerable other points raised, but most of them are not such as I can discuss here without going into many more details and showing more slides, so I conclude by thanking you for giving attention to this very problematical subject I have laid before you, and begging you to remember that I have not put before you many statements of fact. Where there are facts I have tried to make them clear. Where there are merely theories that need proving I have tried to make it clear that they *are* theories, and I and my colleagues propose to go on working on them. I know others will do the same and perhaps in a few years' time we shall have more evidence, less problematical, to put before you.

The PRESIDENT: I do not feel qualified to enter into the discussion of the geological problems, but we can all realize what an important influence one aspect of exploration and geography has on another, how intimately they link up. I was greatly interested in Dr. Worthington's comments, from the zoological point of view, on the theories that the lecturer has put before us. We all, I think, appreciate the force of what Dr. Leakey has been telling us, that on the expeditions of to-day it is quite impossible for one man to deal adequately with more than one or two geographical aspects of exploration, so that it is of the highest importance for the explorer to have with him comrades who can specialize in different scientific directions. No doubt endeavour is being made to organize personnel in that way as far as finances permit in expeditions which are now undertaken, but it is mainly a question of expense.

I now ask you to join me in thanking Dr. Leakey very much indeed for his most interesting lecture. He has touched on a number of problems which will give us a great deal to think about if we are at all interested in the subject, and I hope he will, as he himself hopes, be able to continue his valuable labours on further expeditions which will throw yet more light on the problems which he has dealt with so interestingly this afternoon.

EVIDENCE OF RECENT CLIMATIC CHANGES SHOWN BY TIBETAN HIGHLAND LAKES

H. DE TERRA AND G. EVELYN HUTCHINSON (of the Peabody Museum and Osborn Zoological Laboratory of Yale University)

IN 1905 Ellsworth Huntington[1] observed that the Pangong Tso in Ladakh shows a set of benches and beach-lines which lie lower than any of the older terraces surrounding the lake. The latter, of which Godwin Austen in 1866 said that they must be witnesses of the Ice Age, have unduly diverted the attention of explorers from a less conspicuous but equally important feature: the erosive and bathymetric evidence of recent climatic oscillations on the Tibetan highland lakes.

During the summer of 1932 we[2] had occasion to spend several weeks in the immediate neighbourhood of the lakes Pangong, Pongur, Mirpa, Morari, and Kar in eastern Ladakh along the Kashmir–Tibetan boundary. Our geological and biological work provided, amongst other results, new information regarding changes of depth, of shore features, and related phenomena which bear witness to regional climatic oscillations of Post-Quaternary age. It may encourage those who visit lake shores to gather more data.

The evidence for recent changes of lake-levels is topographic, physiographic, and hydrographic. Data gathered by former explorers most fortunately record changes in level and in local precipitation in Ladakh reaching back over one hundred years, which had made it possible to compare these oscillations and to trace their origin.

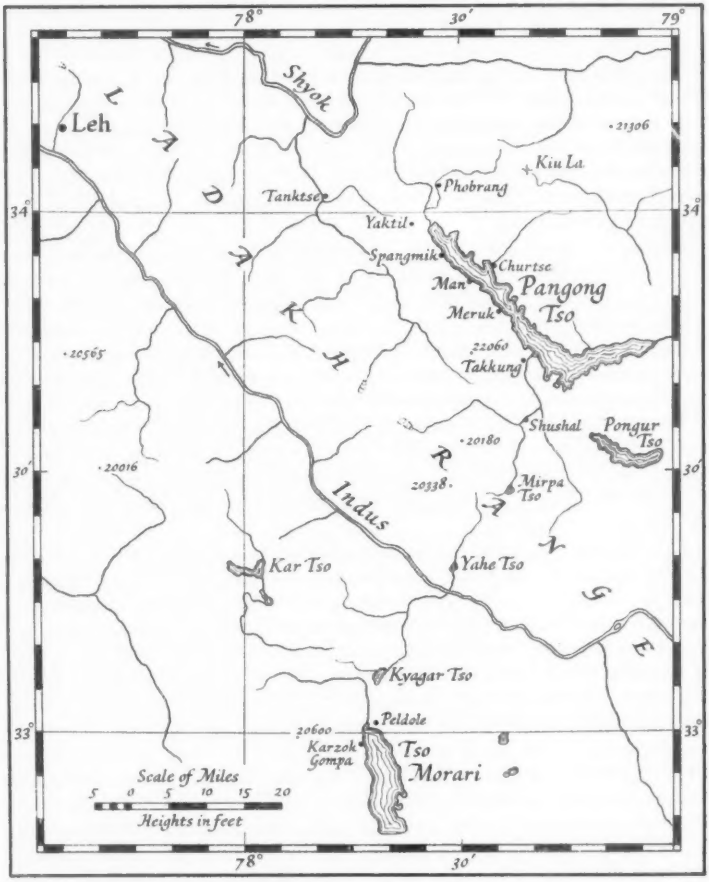
The Pangong Tso, being the largest mountain lake north of the Himalaya (13,915 feet above sea-level), gave the first evidence of recent topographic changes. When our pony caravan attempted to use an old path along the northern shore between Churtse and Lukung we found it impossible to proceed round the base of the cliffs as the path had become flooded. On the promontory which flanks the north-western part of Churtse bay the old path was found well constructed with large slabs of rock, and the road, which first follows a higher beach terrace, could be seen to lead into the lake, where the path continued 5 feet below the water and around the cliff. We noticed two drowned beaches at 3 and 5 feet which may also be recognized on Plate 1. Natives from the hamlet of Lukung corroborated the recent rise of the lake. At some previous date a path had been constructed through the rocks above the cliff, but this road had long been out of use, for we were warned that it had been impassable for years. Sven Hedin[3] however had been able to use it in 1901, from which we may conclude that the natives had since then con-

[1] "Pangong, a Glacial Lake in the Tibetan Plateau," *Jour. of Geol.*, vol. 14, pp. 599–617.

[2] Dr. H. de Terra was leader of the Yale University Expedition to northern India in 1932–33, to which Mr. G. E. Hutchinson had been attached as a biologist (see *Geogr. J.*, vol. 82, no. 4, 1933, p. 379; also *Himalayan Journal*, vol. v, pp. 33–45; and *Geographical Review*).

[3] 'Im Herzen von Asien,' Leipzig, 1903, vol. 2, p. 502.

structed the safer and shorter road along the base of the cliff which eventually had become flooded so that the northern shore road fell entirely into disuse. For this reason the northern trade and shepherd route from Tanktse to Rudok leads nowadays *via* Phobrang across the Kiu La. Our native guide stated also



that the outlet of the eastern Pangong near Ot had become unfordable owing to high water.

A few days later our surveyor, Khan Sahib Afraz Gul Khan, drew my attention to the fact that a rocky islet a quarter of a mile out in the lake from the shore at Yaktil which had been marked as lying 5 feet above the lake-level on the old survey sheet (27.13922′) did not now exist. Hutchinson set out for a line of soundings and found that the shallowest water was 13·1 feet at

the spot where the islet had been in 1861. Thus the lake had risen since then at least 18 feet.

As we proceeded from Lukung to Man and Takkung on the southern lake side further physiographic evidence for a recent rise presented itself. The fan formation which here makes the lake front is seen to be superimposed on the pleistocene deposits and is therefore of post-glacial origin. A young talus-cone at the slope of a cliff between Yaktil and Spangmik showed two distinct beach lines 3 and 5 feet above the water, and a third could be seen in the clear water 2 to 3 feet below the level of the lake. Shortly before reaching this spot the path makes a detour around the advancing water of a shallow bay. Beyond Spangmik several river-beds must be crossed, of which some are deeply entrenched into the fan, which is underlain by glacial and interglacial deposits. In some of the shallower flood channels a more recent heavy accumulation of gravel had taken place, so that the road had been completely obliterated. Former erosion naturally had entrenched the river-bed during a progressive fall of the lake-level until this process had recently been checked, if temporarily, by a rise of the water to which the rivulets had responded by accumulation.

Twelve miles south-east of Takkung the underwater beaches were seen to follow the contours of an old shore-line (Fig. 1). A small delta had here been

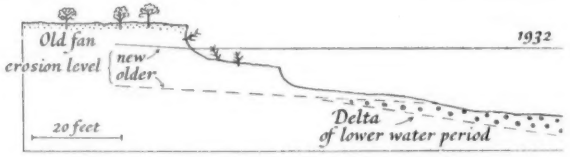


Fig. 1

built into the lake, and as the underwater beaches broke abruptly off along the drowned shallow flood-channel of the rivulet it is evident that the beach preceded the delta. Larger bushes could still be seen clinging to the upper beaches while others had already become uprooted and were tossed about by the waves. These had cut a cliff 7 feet high into the older fan deposit from which the vegetation was breaking loose. The two beaches in front of the cliff had evidently been made at lower water, and owing to a further fall of the lake a younger fan had then been formed in front of them. The rising lake water had then flooded these shore features until the lake is now cutting into the front of the older fan.

Another interesting physiographic change connected with the rise of the Pangong is the formation of small lagoons. They appear in parallel rows along the shore and in one place two could be seen at distances of 3 and 10 feet from the shore. Fig. 2 may illustrate how their peculiar arrangement can be explained by a progressive rise of the lake-level. Their formation is greatly assisted by preceding shore-ice action. The accumulation of gravel and sand in the form of ridges is a common feature along Tibetan lakes (Plate 2). Owing to the severity of the frost, which keeps the lakes solidly icebound during four or five months of the year, shore-ice is a much greater factor of accumulation

than around lowland lakes in middle latitudes. On Tso Morari I measured the beach gravel walls which were piled up by shore-ice to 4 feet high. Huntington[1] and Hedin[2] have pictured the same process. Such walls are found on many of the lagoons, but it is evident that they can survive a temporary inundation only if they consist of coarser gravel or of sand which has become somewhat cemented. During stage 2 of Fig. 2 Terrace A will become slightly hollow as the result of weathering, especially by deflation, whereby the height of the new beach wall is accentuated. Most lagoons on Pangong can be traced back to the same process; particularly where low terraced fans have become inundated, this indicates a recent rise of the lake-level.

There are also new data on soundings which lead to comparison with previous bathymetric work done by H. v. Schlagintweit in 1856[3] and Sven Hedin in 1901.[4] During our expedition soundings were made in the extreme northwestern end of the lake, in the vicinity of trig. station 27 of the survey of 1863, an islet now covered with water. One of these soundings, over the station, can be placed with confidence; the position of the others is very close;

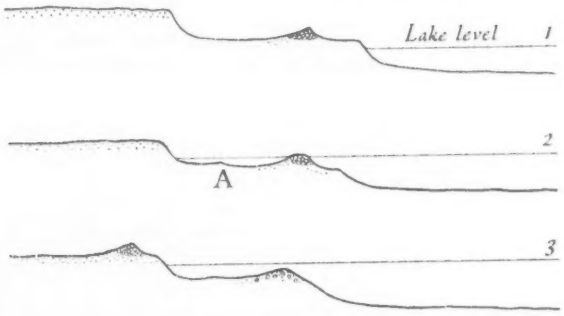


Fig. 2

the soundings near Man can be placed with fair accuracy, but several soundings to the east of Takkung can be located only roughly.

Hedin sounded the lake in 1901. He obtained one long line in the most southern part of the basin and another from Man across the lake to Churtse. The latter may be on nearly the same profile as ours, from which a rise of 15 feet between 1901 and 1932 can be deduced. H. v. Schlagintweit had obtained a maximum depth of 170 feet (51·4 m.) in the centre of the lake opposite Takkung. He also made two lines across the lake, one from Meruk, the other from Man. In the latter a maximum depth of 148·4 feet (45·1 m.) was encountered. When Schlagintweit's profile across the lake at Man is drawn, and the portion of the profile represented by our soundings then drawn below the older profile, the deeper of our soundings is found to lie just north of the central sounding of Schlagintweit's series. By comparing Schlagintweit's

[1] *Op. cit.*, Fig. 4.
[2] 'Scientific Results of a Journey in Central Asia, 1899–1902,' vol. iv, Stockholm, 1907.
[3] 'Reisen in Indien und Hochasien,' Jena, 1872, vol. 3, p. 172.
[4] *Op. cit.*, pp. 333 ff.

middle sounding of 140·0 feet (42·6 m.) with the point on our profile immediately below it, a rise of water-level of 19·4 feet (5·9 m.) can be deduced, and approximately the same rise is given when our deeper sounding is compared with Schlagintweit's profile. Our shallower sounding lies under a part of Schlagintweit's profile at which the depth is changing too rapidly to give any data of value. From a consideration of the present depth of the islet which was covered with water before 1859, it is clear that this figure of a net rise of 19·4 feet (5·9 m.) since 1856 is too great. In all probability the lines of Schlagintweit's soundings and ours do not exactly coincide. From the rate at which the island rose after 1859 we are probably justified in supposing that the lake was 10 feet (3 m.) shallower in 1856 than in 1932. Comparison of the areas of the profiles of 1856 and 1932 shows an increase of 18 per cent. corresponding to a rise of 19·4 feet (5·9 m.); since this is about the total rise between the minimum and to-day, we may assume an increase of volume of about 18 per cent. since the sixties of the last century.

The general correctness of the information obtained is however confirmed by a multitude of earlier observations all indicative of changes of the Pangong level. These historic data have been condensed in diagrammatic form on Fig. 6. For reference this list of historic data can briefly be summarized as follows:

1. W. Moorcroft and G. Trebeck ('Travels in the Himalayan Provinces of Hindustan and the Punjab,' London, 1831, pp. 401, 435) gave the first account of Tso Pangong and mention the lack of a road along the northern shore in 1821.

2. H. Strachey ("Physical Geography of Western Tibet," *Jour. Royal Geographic Soc.*, vol. 23, 1853), who visited the lake in 1848, remarks on the outflow of the eastern Pangong at Ot. His native guide, who had been with Moorcroft, said that the lake had perceptibly receded in the last twenty-seven years.

3. H. von Schlagintweit (*op. cit.*, vol. 3, pp. 168 ff.) relates native information according to which higher lake-levels in connection with good harvests were frequent before 1841. In 1856 soundings were made but no rock islet is mentioned.

4. H. H. Godwin Austen ("Notes on the Pangong Lake District of Ladakh," *Jour. Asiatic Soc. Bengal*, vol. 37, pt. 2, pp. 84–117, 1866) surveyed the rock islet in 1863 which appeared in 1859 above the lake-level. Shore roads were passable. He observed five to six beach-lines, 1 foot distant from each other, and also a submerged lake terrace, 10 feet below the 1863 level. From these phenomena he infers climatic oscillations.

5. In 1869 F. Drew ('The Jummoo and Kashmir Territories,' London, 1875) pictures the islet and mentions a total seasonal rise and fall of the lake by 3 feet.

6. M. S. Wellby ('Through Unknown Tibet,' London, 1898) had the choice to use either the shore route or the longer but safer one across the Poranda La.

7. Sven Hedin (*op. cit.*) gives soundings of 1901 and comments on the condition of the northern shore route which was inundated, but the river at Ot was fordable. The existence of an older road, 10 m. above the path which he followed, makes him believe that his road of 1901 was once flooded.

8. E. Huntington (*op. cit.*) observed in 1905 three to four small drowned beaches 10 to 12 feet below the level, and gives native information according to which the lake was 10 to 12 feet lower during 1875–85. Although he recognized that oscillations were recent he attempted to couple them with the formation of clay and gravel deposits near Man which Godwin Austen in 1866 had rightly interpreted to be of glacial and interglacial origin.

To this historic record must be added a chemical analysis of the lake water made for Henderson and Hume in 1871.[1] A comparison of the chloride content of the lake as given by him with that found in 1932 indicates that the lake has been diluted by fresh water by 16 per cent. of its former volume since that date. This increase in volume is comparable to the increase of 18 per cent. in area of the cross-section at Man indicated above.

The whole clearly indicates that within 112 years Tso Pangong has experienced one low and two high levels.

Tso Morari, in the district of Rupshu on the Himalayan side of Ladakh, presents indisputable evidence of a recent rise. The prayer or mani walls on the western shore between Karzok Gompa and Peldole were half washed into the lake when we passed there in August 1932 (Plates 3 and 4). The path

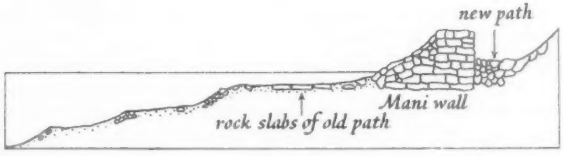


Fig. 3

did not bifurcate at the end of the prayer wall as it should, and the natives had started building a smaller mani 4 feet farther inland on the other side of the road. Plate 3 and Fig. 3 show the ruined state of this monument, and the drowned terrace across which one branch of the path led round the other side of the mani, as is required by lamaistic rite. The destruction of an older shore road became visible all the way. The people had in some places carried it across young talus 10 feet higher up. Three drowned beach-lines could clearly be seen under water as Fig. 3 illustrates, and from a higher location above the shore one could readily follow three or four of the drowned beaches all along the shore. Some lagoons occur in a beach, their spits lying 5 inches above the level. Strewn with coarse gravel and boulder they indicate a formation similar to the one formerly described. On the eastern shore also there is a drowned path 5 to 6 feet beneath the water which leads around a rocky promontory south of the plain called Titta.

Our soundings on Tso Morari showed that the lake was 160–165 feet (49 m.) deep, midway between Karzok and Peldole about 500 feet (150 m.) in from this shore. One of Drew's lines of soundings lies a little to the south, running

[1] Frankland, in Appendix B of Henderson, G., and Hume, O. A., 'Lahore to Yarkand,' London, 1873.

Plate 1. Pangong Tso: drowned beaches

Plate 2. Pangong Tso: accumulated gravel and sand

Plate 3. Tso Morari: prayer wall partly washed away

Plate 4. Tso Morari: remains of submerged prayer wall

due east from Karzok. Unfortunately it is not possible to make any comparison owing to the probable variation in the slope of the lake bottom in this region.

On *Kyagar Tso* a well-defined beach with a gravel wall made by ice-push was noticed 3 feet below the present level; within this are two less well-marked beaches. Drew found the deepest point to be in the south-west corner of the lake, where he ascertained a depth of 67 feet (20·4 m.). In the same part of the lake we obtained a depth of 69·6 feet (21·2 m.). It is probable that the water-level has risen about 3 feet in the last fifty years.

The small glacial lake, *Yahe Tso*, which is drained by a northern tributary of the Indus, showed one drowned beach at 6 feet and two others at a depth of 3 feet and 1 foot along the south-west corner. A sharp drop from the 3-foot contour at the north end of the lake may represent the second of these beaches. At the present the lake has an outlet, so large changes in water-level could not be expected.

Mirpa Tso is a glacial lake without outlet in a *kar* basin of the Ladakh Range south of Shushul. It presents drowned shore-lines at 1, 2, 3, and perhaps 4 feet. The former three are very conspicuous and can be clearly seen along the southern shore where there is also a larger set of higher and older shore-lines. The drowned beaches give here clearly the impression of being the youngest features resulting from continuous post-glacial desiccation which had been checked by the recent rise of the lake-level.

On *Pongur Tso* remains of a drowned beach, about 1 foot below the present level, were observed in several places along the western end of the southern shore.

During Dr. Trinkler's expedition in 1927 de Terra noticed a drowned river terrace at the eastern end of the Aksai-chin lake where a small river flows into it. The terrace is cut into clay deposits and was overstrewn with gravel, lying 1^1_2 feet under water. The lake shore showed a sandy gravel beach wall 1 foot high which lay on top of a drowned terrace 2 feet below the level.

Outside the region which is known to either of the authors the lake system of Manasarowar and Rakas Tal in Tibet gives a remarkable record of oscillations which have become known through various descriptions.[1] Until the middle of the eighteenth century Lake Manasarowar regularly flowed into Rakas Tal and the latter apparently into the Sutlej. Since 1804 the flow from Manasarowar into Rakas Tal has been recorded as intermittent and no certain records exist of water leaving Rakas Tal. The channel from Manasarowar is but a few feet above the lower level of the lake, and thus a small rise will suffice to convert the dry bed of the effluent into a river. Fig. 5 gives the record of observations available since 1804.

The Climatic Cause of the Changes in Lake-levels

As most of the lakes mentioned receive their water supply from glaciers or snow-fed rivers, it seems at first obvious to couple the recent rise of lake-level

[1] The last observations were recorded by Messrs. F. Williamson and F. Ludlow in 1932 (*Him. Jour.*, vol. 5, p. 103). See also Kashyap, *Jour. Asiatic Soc. Bengal*, N.S., vol. 25, 1929, and Sven Hedin, 'Southern Tibet,' vol. ii, Stockholm, 1917, pp. 171–188.

with an increase in the amount of melting water. In such a case we would expect to find widespread evidence of glacier retreat and possibly a rise in the snow-line. In the case of the Pangong lake basin however no trace of general glacier retreat could be detected. The numerous glaciers on the Pangong range south of the lake have irregular movements, and on the whole they seem at the present to be stationary so far as one can judge from topographic evidence. Mirpa and Yahe Tso have no glaciers in their immediate neighbourhood, and yet they also show drowned beach-lines. Another argument against an increased ablation is the fact that numerous patches of valley névé in eastern Ladakh have hardly changed their size in the last eighty-three years. Strachey[1] noticed one cake of valley névé in southern Rupshu 4–5 inches thick and several acres in extent, and another one in 1848 in the Mirpa Gongma which lies in the Pangong catchment area. The latter had, according to our observation, hardly lost in size and not at all in thickness. H. v. Schlagintweit[2]

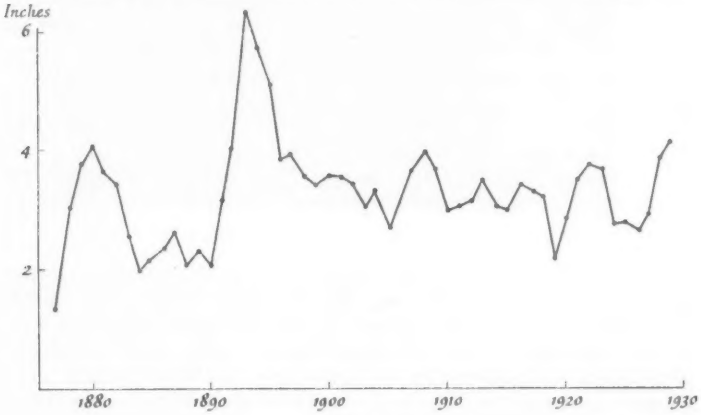


Fig. 4

reported similar névé from the Aksai-chin in 1857 which Drew[3] rediscovered in 1870, and the 4 inches of firn, 1 mile long and a quarter of a mile wide, still seemed to exist unchanged. One would think that a slight increase in temperature or solar radiation would suffice to melt such isolated and unprotected névé. The recent rise and the previous changes of lake-level cannot be traced to an increased supply of melting water, and as the phenomenon as such is one of regional extent, it must be due to changes in precipitation.

The meteorological station at Leh, which is about 50 miles north-west from Pangong as the crow flies, has registered the rainfall since 1876. A comparison between Fig. 4, which gives the changes of rainfall and the curve, and Fig. 6, which illustrates the changes of lake-level at Pangong, shows that an increase in precipitation between 1890 and 1900 corresponds with a rise in

[1] R. Strachey, "Physical Geography of Western Tibet," *Jour. Royal Geogr. Soc.*, vol. 23, 1853.

[2] *Op. cit.*, vol. iv, p. 82.

[3] *Op. cit.*, p. 353.

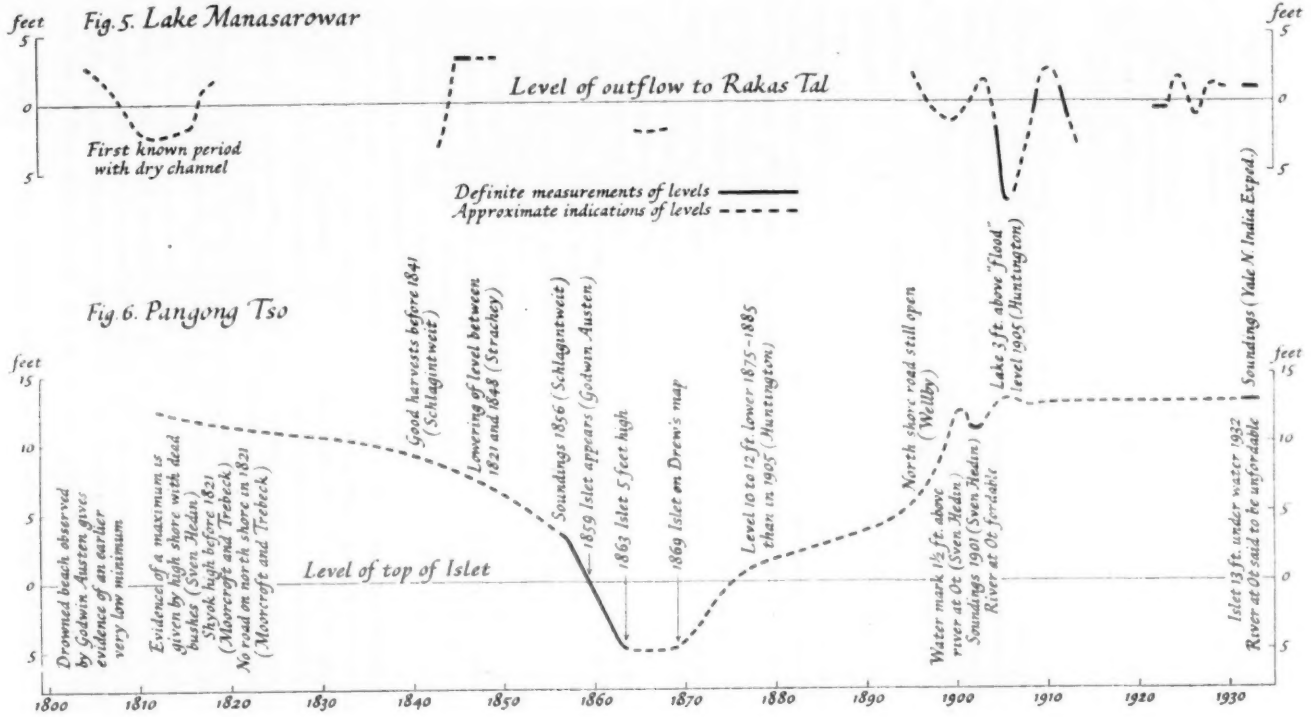


Fig. 5. Lake Manasarowar
feet
5
0
5
First known period with dry channel
Level of outflow to Rakas Tal
Definite measurements of levels
Approximate indications of levels
Fig. 6. Pangong Tso
feet
15
10
5
0
5
Drowned beach observed by Godwin-Austen gives evidence of an earlier very low minimum
Evidence of a maximum as given by high shore with dead bushes (Sven Hedin)
Shyok high before 1821 (Moorcroft and Trebeck)
No road on north shore in 1821 (Moorcroft and Trebeck)
Level of top of Islet
Good harvests before 1841 (Schlagintweit)
Lowering of level between 1821 and 1848 (Strachey)
Soundings 1856 (Schlagintweit)
1859 Islet appears (Godwin-Austen)
1863 Islet 5 feet high
1869 Islet on Drew's map
Level 10 to 12 ft. lower 1875–1885 than in 1905 (Huntington)
North shore road still open (Wellby)
Water mark 1½ ft. above river at Ot (Sven Hedin)
Soundings 1901 (Sven Hedin)
River at Ot fordable
Lake 3 ft. above "flood" level 1905 (Huntington)
Islet 13 ft. under water 1932
River at Ot said to be unfordable
Soundings (Vale W. India Exped.)
1800
1810
1820
1830
1840
1850
1860
1870
1880
1890
1900
1910
1920
1930

the lake-levels.[1] Since all the lakes of western Tibet appear to behave in a similar manner inasmuch as all seem to have risen recently, it is tempting, though perhaps fruitless, to speculate whether the pronounced lowering of the Pangong Tso during the middle of the last century may not be a manifestation of the same influence that has cut off Rakas Tal from its drainage to the Sutlej.

In the case of Lake Manasarowar Hedin has pointed out that a high level leading to a filling of the channel follows, at least in some years, a heavy snowfall. It is obvious that this lake must react more sensitively to such changes in precipitation than does Pangong Tso, for only a slight rise in its level suffices to produce a refilling of the river at its outlet, an event which is more striking and more frequently noticed by travellers than the temporary formation of beach-lines. Examination of the relatively complete data for the present century indicates that a very small fluctuation in climatic conditions is responsible for the flooding and drying of the channel.

Altogether it may be stated that the recent rise of the water-level in the lakes of Ladakh is due to increased rainfall. Such an increase of rainfall is, as has been shown by Brooks[2] for the thirty years prior to 1910, apparent throughout almost the whole of the temperate part of the Eurasiatic continent. This has a definite bearing on the question of the water supply in high Asia which is always quoted as if undergoing a process of continuous desiccation. That this is not the case may be inferred from the foregoing evidence. It is not improbable that in the long run desiccation might go on or that it might become definitely checked by a general increase in rainfall, but in either case it is a discontinuous process.

In view of the fact that this region borders on one of the most glaciated mountain regions on earth, namely, the high Karakoram, it is inviting to compare our figures with those given by Mason[3] for the movements of the Karakoram glaciers. The Chong Kumdun glacier, famous for its tendency to block both the Central Asian trade route and the upper Shyok river and therefore the most accurately observed glacier, has experienced two principal advances within ninety years, one before 1842 and another from 1925 until to-day. Both long-lasting advances appear to correspond roughly with our Pangong rises. Visser[4] states that the glaciers of the Saser group had recently advanced, which would also correspond to the recent rise in lake-level.

It appears therefore as if definite relationships exist within this region between oscillations of precipitation, of lake-levels, and larger glacial movements. The geological significance of this lies in the fact that these slight oscillations of climate in Indian Tibet, occurring as they do in a much elevated region, seem to be of a similar, though much smaller, order to those which determined glacial and interglacial periods during the Ice Age.

[1] The authors considered that such changes of lake-level might be correlated to sunspot cycles such as the Brückner or Wolf cycle. In view of the uncompleted range of observations from this local area, it was thought advisable not to stress this point until a wider study of such phenomena can be made.

[2] "The Secular Variation of Rainfall," *Quart. Jour. of the Royal Meteor. Soc.*, vol. 45, 1919, p. 240.

[3] Kenneth L. Mason, "The Glaciers of the Karakoram and Neighbourhood," *Rec. Geol. Surv. India*, vol. 63, pt. 2, 1930, pp. 214–277.

[4] Ph. C. Visser, *Zeitschr. f. Gletscherkunde*, vol. 16, 1928.

THE MENDOZA RIVER FLOOD OF 10–11 JANUARY 1934—ARGENTINA

W. D. V. O. KING

SHORTLY after 1 a.m. on 11 January 1934 a very exceptional flood passed over the Cippoletti weir at Lujan de Cuyo, whence the main supply of irrigation water to the vineyards around the City of Mendoza is taken. Already during the previous afternoon telephonic advice had been received from Punta de Vacas station at Kilometre 143 on the Transandine Railway that the Mendoza river had been rising rapidly since 3 p.m. and the sluice gates opened in anticipation. The flood therefore covered the distance between these points at an approximate mean velocity of 4 metres per second.

The weir is constructed of concrete faced with stone and is connected to the opposite bank by an earth embankment, the overall length across the river being 772 metres. The embankment was breached at 2 a.m., but it has been estimated approximately[1] that some 60 million cubic metres of water passed Lujan during the period of flood, during which time the highest discharge may have reached 3000 cubic metres per second. Hot-weather floods vary between 130 and 250 cubic metres per second, but 500 cubic metres/second has been recorded on several occasions. The Electric Power Company's gauge at Cacheuta was submerged, so that no useful information is available from that locality.

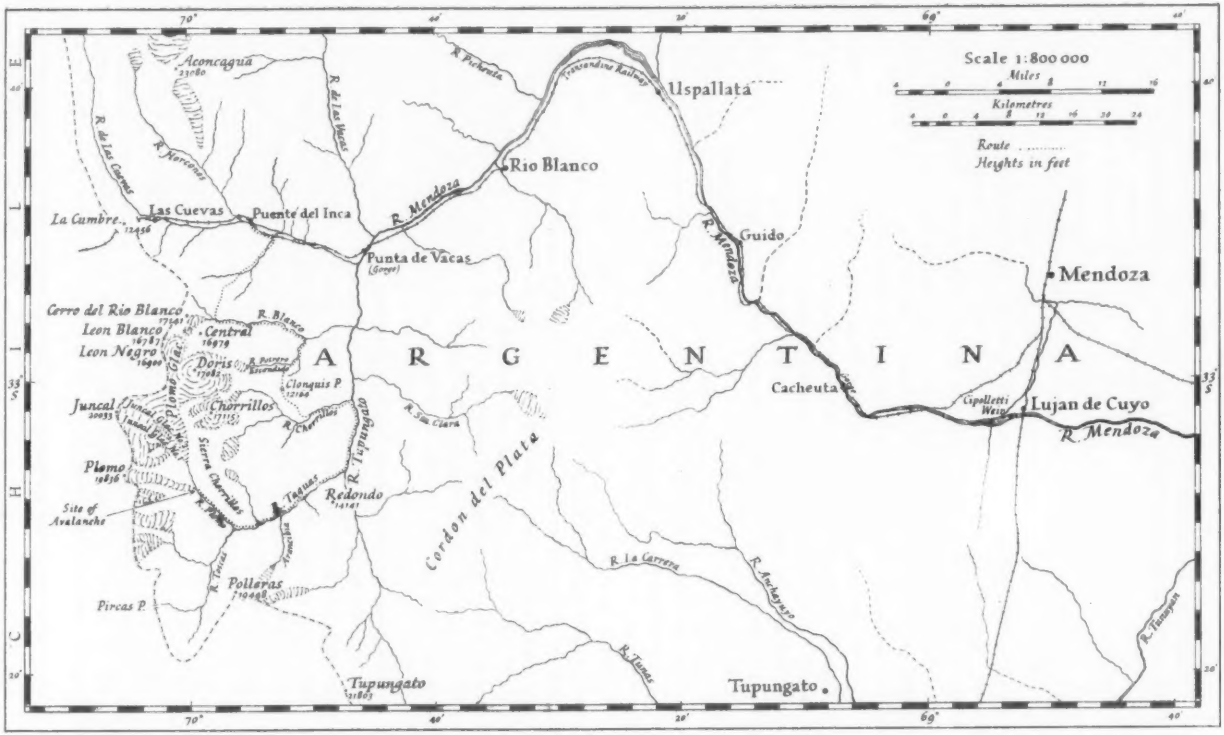
At Punta de Vacas rough calculations show that some 67 million cubic metres passed through the gorge with maximum rate of discharge 2887 cubic metres per second. Previous exceptional floods, but not so great as the present, were recorded in 1888, 1900, and 1915.[2] These figures are of interest as observations made at the point of discharge 53 kilometres upstream from Punta de Vacas show that only some 55½ million cubic metres were available in the temporary lake formed. [The figures are discussed more fully in a technical appendix by Mr. M. G. Wilson, which will be preserved in the Library.]

A contemporary cloud-burst, of which there is no evidence, may have added to the volume, but a possible explanation of the discrepancy lies in the fact that at each successive gorge the flood would have been checked temporarily by its load of debris, resulting in a series of accumulations of water, and thus giving a false impression of the discharge at those places. Exceptional heat, registered at the time, would also have caused an abnormal flow in the river Mendoza and tributaries below the reservoir. Further, it is possible that another ice-dammed lake existed undiscovered in the area and was discharged simultaneously.

As some loss of life and about half a million pounds damage to private and public property had been incurred, an aerial reconnaissance over the Cordillera was carried out by the Mendoza Provincial Government on 16 January 1934. Photographs showed a blockage by a glacier in one of the valleys somewhere

[1] Report of a commission presented to the Mendoza Government, dated 19 January 1934.

[2] 'Estudios sobre irrigacion en la Provincia de Mendoza,' 1924.



Headwaters of the Mendoza river, Argentina

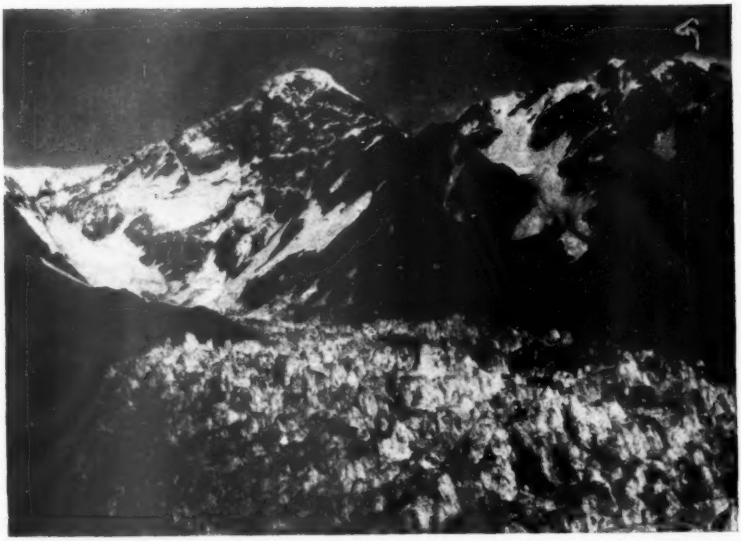


Plate 1. South-east face of Cerro Plomo and the glacier which caused the ice dam

Plate 2. Cacheuta power station on the Mendoza river, looking upstream

Phots. A. T. R. Co.

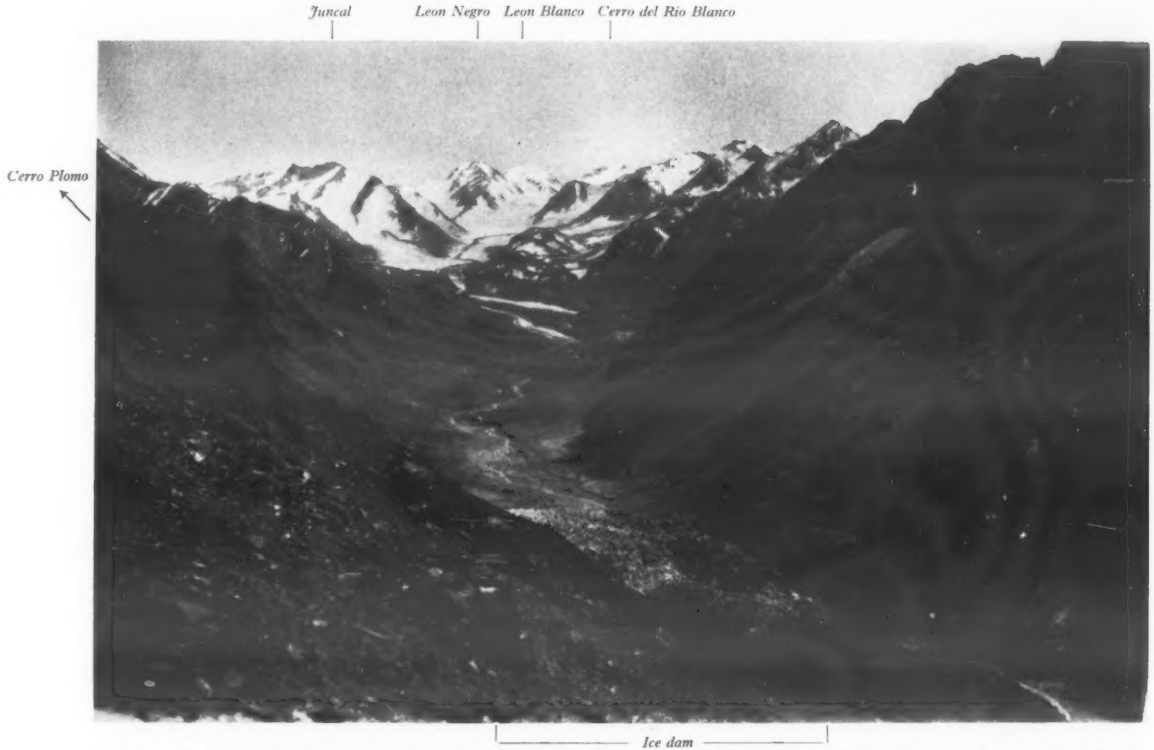


Plate 3. Looking north-east up the Rio Plomo valley to the Plomo glacier beneath Leon Negro and Leon Blanco; ice dam caused by tributary glacier of Cerro Plomo (outside picture to left)

near Mount Tupungato. On 1 February 1934 the writer, accompanied by Mr. Yorke Eliot, left Puente del Inca with instructions to locate the supposed glacier on the ground and report on future possibilities.

The Tupungato valley has been described by Vines (1897) and subsequently by Larden. The latter spent the month of February 1909 with Helbling, who with Reichert had been engaged at intervals from 1907 to 1912 exploring and mapping the region between Puente del Inca and Cerro Tupungato. No difficulty therefore was to be expected in searching the area, except that none of the mule-men picked up at Puente del Inca had been in it, and that some route other than up the Tupungato valley had to be found. This valley was known to be impassable in high flood at least as far as the mouth of the Chorrillos stream, above which the valley widens out and might allow a passage upstream without frequently crossing the river Tupungato.

The Chorrillos–Tupungato junction was reached eventually by crossing the spurs between the tributaries on the left bank of the Tupungato river and descending the Chorrillos stream. This crossing proved difficult in places, especially during the descent into the Chorrillos valley, where steps in rock had to be cut for the mules. The Blanco, Potrero Escondido, and Chorrillos valleys were examined for possible additional cause of the big flood, and there was always the pleasing probability of finding the Panagra passenger plane *San Jose*, lost since 16 July 1932, for which an award was offered. It was found on 22 March 1934, at the head of the Blanco valley.

Ice bridges exist in the Blanco and Potrero Escondido valleys, but in each case the water was flowing freely underneath, and the steep grade of the drainage line does not allow any dangerous quantity of water to be dammed up if the bridge is blocked by roof falls. The Potrero Escondido stream flows into the Blanco valley through a narrow gorge, and there it was evident that an abnormal body of water (150 cubic metres per second) had recently passed.

Some 10 kilometres above the point where the Chorrillos stream joins the Tupungato valley the fine view of Polleras mentioned by Vines and Larden is obtained. Here also the Tupungato valley continues to the south as a narrow gorge, while a wide valley (Taguas) forks south-west and leads to the Plomo glacier. Reichert rightly suggests that the whole valley from the snout of the Plomo glacier to Punta de Vacas should have been designated the Plomo and not the Tupungato. The latter at the Taguas fork supplies an insignificant hot-weather flow of possibly one-tenth of that from the Plomo and Toscas rivers.

The Taguas valley was followed up to the Toscas–Plomo fork after visiting the hot springs mentioned by Larden. These are on the right bank just above where the Arancibia stream joins the Taguas river. The water temperature was 35° C.[1] and the air 14° C. At two springs about 1 kilometre up the Arancibia stream the water temperature was 14° C. and the air 16° C. There is another spring on the left bank of the Taguas river immediately below the Toscas–Plomo junction with water 23° C. and air 18° C. Directly opposite the first-mentioned spring, *i.e.* on the right bank of the Taguas river, an outcrop of limestone is crowded with the same fossils of Upper Jurassic age as at Puente del Inca.

[1] Reichert, p. 160, 30° C., on 3 February 1908.

Before continuing up the Taguas valley, a peak (Cerro Redondo, 14,141 feet) lying between the Tupungato and Taguas rivers was ascended by mule to get a view of the country. A few compass bearings were plotted on Helbling's map, thus locating the glacier seen on the air photographs as descending from the south-east face of Cerro Plomo. The peaks in the region, from south to north, have been climbed:Tupungato (21,803 feet) by Vines and Zurbriggen in April 1897, and by Reichert and Helbling in January 1912. Polleras (19,498 feet) by Reichert in February 1908. Plomo (19,836 feet) by Helbling, Reichert, and Bade in January 1910. Juncal (20,033 feet) by Helbling, Reichert, and Beiza in January 1911.

Hidden behind the Chorrillos range is the glaciated region of the river Plomo and peaks Leon Negro, Leon Blanco, Cerro del Rio Blanco, Doris, and Central, all of which (except the Leon Negro) were climbed by Reichert or Helbling in 1911–12.

Reichert claims to have been the first to discover and describe the glaciers lying within the Plomo, and adds that these are not shown on the map dated 1898 attached to General J. M. Serrato's 'Ejército y Militarismo,' 1928. He first saw this valley when climbing the Cerro del Rio Blanco in January 1908, and compares the view with that over the Aletsch glacier as seen from the Jungfrau. The main Plomo glacier was 16·7 kilometres long in 1908, and with its feeders drains an area of 200 square kilometres. A general retreat since then is obvious from a comparison on the ground with Reichert's and Larden's photographs facing pp. 180 and 226 respectively. The lower portion of the Plomo glacier is now represented by two thin streaks instead of a broad lobe, while the glacier Juncal No. 1 has retreated up its valley and is not now visible from the same viewpoint. Reichert had erected posts marking the position of the Plomo glacier's snout, but it was unfortunately found impossible to reach them for the reasons stated later. Helbling traversed the whole length of the glacier alone in two days and one night in March 1908.

The whole of the flow from the region just described was found to be obstructed by an avalanche. It had slipped down over the glacier which occupies the upper part of a lateral valley on the south-east face of Mount Plomo, and following down the line of the gulley excavated by the stream issuing from its snout had crossed the Plomo valley and butted up against the opposite rock face, where it had spread sideways as shown in the air photographs.

The above-mentioned gulley or channel is lined with ice apparently forced into the sides by the descending avalanche which may have filled it completely at the moment of fall, the momentum being so great as to plough out enormous rocks from the bottom or sides and distribute them along and over the sides. Since then the residue of the avalanche has melted down within the channel and the upper surface now lies some 50 metres below the lips.

The total length of combined glacier and avalanche was 9 kilometres. The width of the avalanche varies from 200 metres (at the exit of the lateral valley) to 600 metres in the Rio Plomo bed, above which it stood 80 metres on 5 February 1934. The two pits seen in air photographs some 60 metres in diameter and 5 metres deep are subsidences due to collapse of the roof of the

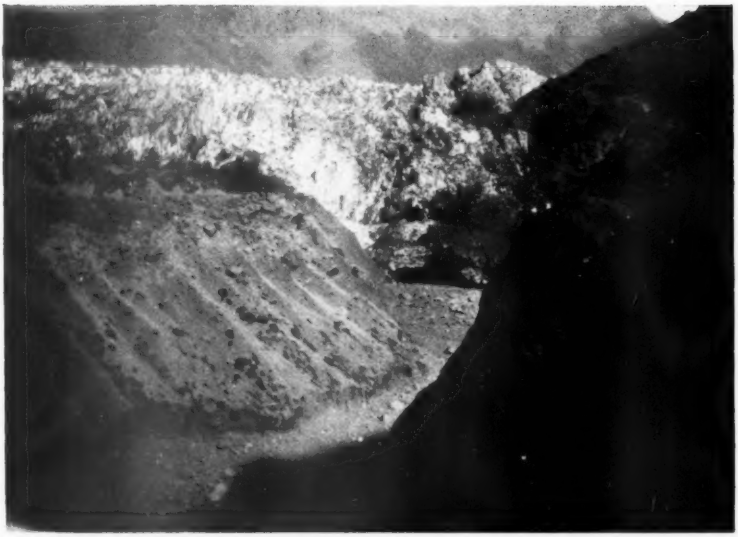


Plate 4. Ice dam in the bed of the Plomo river, the channel or "exit" showing as dark area in the centre

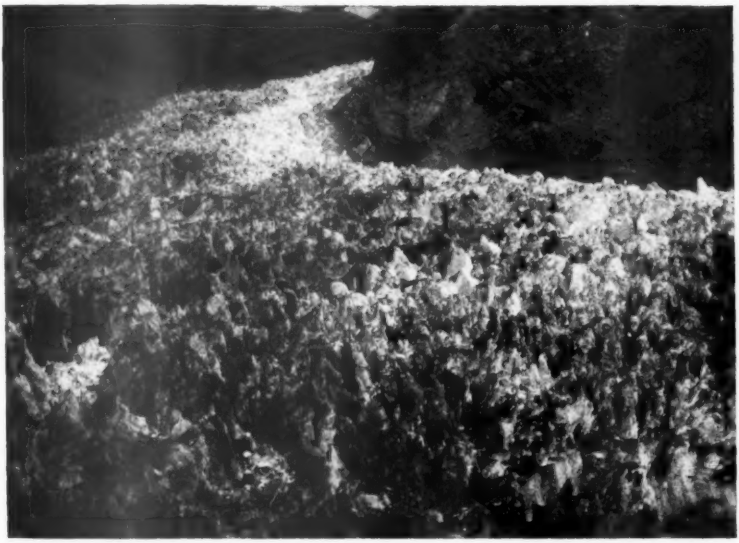


Plate 5. The avalanche blocking the Plomo river, 650 feet wide at narrowest point, seen from the left bank

Plate 6. Lower part of the Punta de Vacas gorge, showing the railway bridge which was destroyed by the flood

Plate 7. Cerro Plomo and the upper part of the tributary glacier

underlying water channel and were the probable cause of the flood, as suggested later. A few rocks only were noticed within the mass, and the surface was dusted with wind-borne dirt. It was not possible to judge the length of the avalanche as the snout of the pre-existing glacier is now buried. Helbling's map to scale 1 : 250,000, dated 1910–14, places the snout at the exit of the lateral valley at 3250 metres level, but if the glacier has retreated since that date at the same rate as the others in the region, then its length might have been reduced to $4^1/_2$ kilometres, in which case the avalanche must be $4^1/_2$ kilometres long, the distance from the head of the cirque to the Plomo river being 9 kilometres. The total contents of the avalanche are estimated to be 54 million cubic metres.

Some 15 to 20 metres appear to have been melted off the surface since the fall occurred, the whole now having the appearance of a heaped mass of ice and snow with pinnacles of that height resembling *nieve penitente*. The total length obstructing the Plomo valley is 1100 metres, with slope 8° to 10°, and lower end at level 3080 metres in the river-bed.

Origin and Possibility of Further Falls

A comparison on the ground (Plate 1) with Reichert's photographs facing pp. 204, 208, and 216, shows remarkably little change in the extent and position of the ice cornices on the south-east face of Mount Plomo over a period of twenty-five years. The avalanche therefore must have originated in the snowfield at the head of the valley. The area of this is unknown, but as it lies on the watershed it cannot be of any great width, and consequently many years must pass before sufficient snow can accumulate again and get into an unstable condition. It is thought that the ice cornices at present hanging on the face of Mount Plomo are of insufficient volume to cause any inconvenience lower down when they fall.

The exit of the ice bridge under which the river Plomo flows measured 10 metres wide by 2 metres high on 5 February 1934, but these dimensions have been diminished by subsidence at the soffit on melting (Plate 4). The river-bed for 4 kilometres below the exit has been raised some $1^1/_2$ metres in the centre by deposition of rock and silt. This debris is pitted with large holes left by the melted ice blocks carried down within it. The same high centre level (but in a minor degree) had already been noted many kilometres lower down, the river during flood overflowing at almost right angles towards the sides of the valley. Such accumulation at the centre may account in part for the observed extra height of some floods at the centre (see Hearn, *Min. Proc. Inst. C. Eng.*, p. 267, vol. 230. The same volume contains data of the 1929 flood of the Indus, caused by breakage of the Shyok glacier-dam, analogous to that under discussion).

That the avalanche fell at a very recent date is obvious from an examination of the face where it butts up against the right bank of the Plomo river, and where the vegetation is still living under the mud and rocks which have been pushed uphill in front of the nose. Since then the ice and snow have melted 5 to 10 metres back from the rock-face. The fall most probably took place in October 1933, during which month abnormally high temperatures were recorded at the Panagra Meteorological station at the Cumbre near Las Cuevas. As the

mass lies much below snow-level it is only a question of time, say two to five years, before the whole will have melted away, provided no further falls occur. Readings taken at the supposed position of the now buried glacier snout (level 3875) gave temperatures 20° C. in sun and 13° C. in the shade at midday on 5 February 1934.

It was unfortunately found impossible either to pass the rock falls on the left bank of the Plomo river, or to cross the avalanche, so that the now empty lake basin could not be examined closely. A line of drowned vegetation was however clearly defined, and the height above river-bed estimated at from 30 to 40 metres at the dam face. Above this several other parallel lines run like contours, and may be lake terraces. These are quite fresh and obliterated only in part by mud runs; they may mark temporary rises of the lake-level just prior to emptying, in which case its capacity may have reached 55½ million cubic metres, assuming a depth of 75 metres at the dam face.

It was apparent from observations that the dam was not overtopped by the water at any point, and it is considered evident that it was undermined by the creep of water beneath its base at the deepest point from the moment the avalanche fell. A discharge channel there formed persisted until the one or both plugs seen in air photographs fell through the roof and blocked the channel until they were blown out by the pressure of water behind the dam.

A repetition of such blockage obviously is to be expected so long as the dam exists, especially during the spring and summer. While the channel remains open there is no danger, and if it remains open for two years, the greater part of the dam may probably have melted away. Meanwhile, as a temporary measure of safety, it appears advisable to cut a relief channel through the avalanche at such a height as to discharge any water accumulated before it reaches a dangerous level in the basin; or alternatively (for permanent safety) to drive a by-pass tunnel through the rock on the left bank. Until either of these measures are adopted periodical inspections of the site by airplane should be carried out, with a frequency which should be determined by the fact that the mean flow of the river Plomo in hot weather is 10 cubic metres per second or sufficient to fill the reservoir to a dangerous level in thirty to forty days.

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'The Highest Andes,' Fitzgerald, 1899; 'Argentine Plains and Andine Glaciers,' Larden, 1911; 'La exploracion de la Alta Cordillera de Mendoza,' Reichert, 1929, which contains an excellent list of publications on the Cordillera de los Andes.

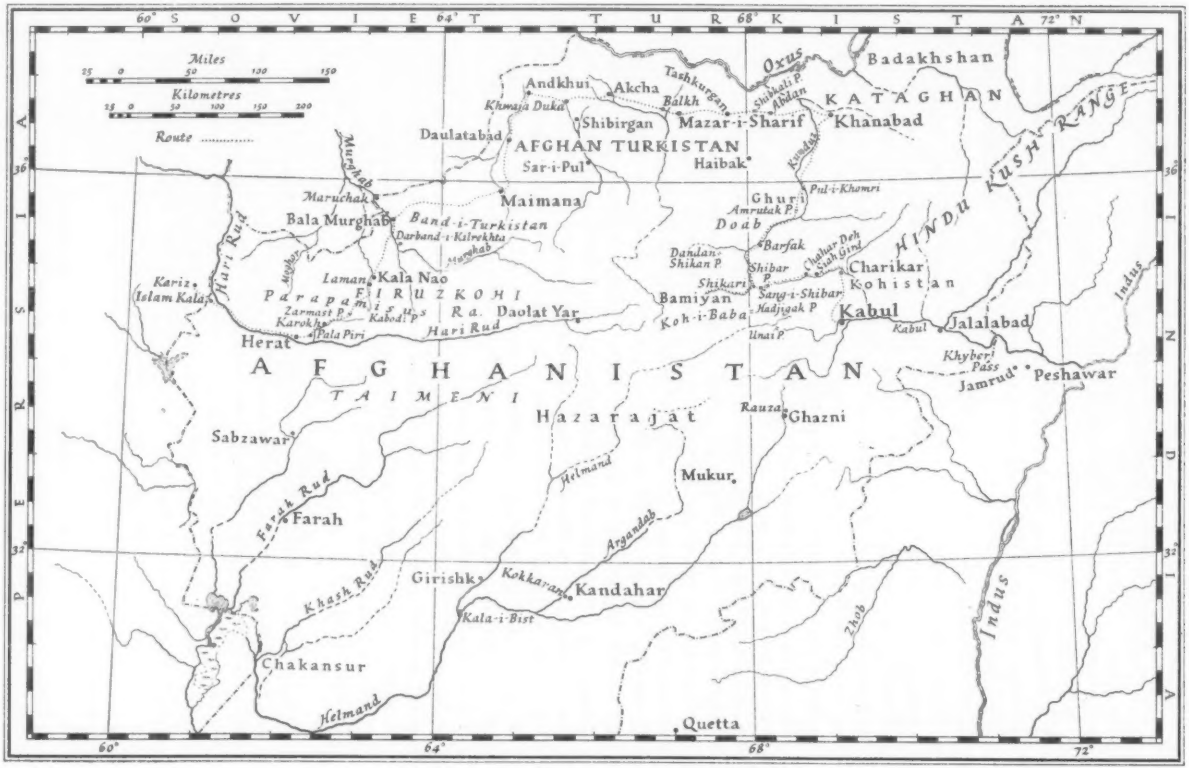
SOME NOTES ON A RECENT JOURNEY IN AFGHANISTAN

CHRISTOPHER SYKES

MY original objective was Luristan, which I hoped to visit in the autumn of last year. At no time is it easy to obtain the necessary permits from the Persian Government, who are anxious for the safety of foreigners and fear lest Luristan might give the visitor a too sensational impression of their country. But the time which I had chosen for making preliminary arrangements at Tehran was especially unfortunate. A very bad impression had been created in official circles in Tehran by the narrative which a foreign expedition published in a newspaper, particular exception being taken to the account of thrills and perils. The ultimate effect was an order from a high authority forbidding travellers to enter the Luristan and Bakhtiari provinces, and I was the first to feel the weight of this heavy penalty.

Other interests occupied me in Persia until the spring of this year, when the opportunity presented itself through the kindness of His Excellency the Ambassador of Afghanistan to Persia, Sher Ahmad Khan, to make a journey to Afghanistan and the less-known provinces of that country: Turkistan and Badakhshan. My friend Mr. Robert Byron had already attempted this journey in the winter. He is engaged on a work dealing with Islamic art in Persia and Afghanistan, and the object of his attempt was to visit Herat, Balkh, and Ghazni. He left Tehran at the beginning of November, crossed the Parapamisus, but was unable to go farther north than Kala Nao owing to heavy rains, and snow on the Turkistan pass. Nevertheless this short reconnaissance journey was, owing to his habit of acute observation, of great assistance to us on the second venture when, disappointed in my hopes of seeing the remote and great in Persia, I joined him. Much of the recording of the road was his work, of which I believe the public is to be offered a more detailed account in the form of a travel book from his pen. I offer these notes as likely to be of interest to readers of this *Journal*, not because of any valuable geographical observations made, but because these provinces are not often visited and as yet few travellers have done the journey by car, particularly by the Tashkurgan–Khanabad road.

We entered Afghanistan from Persia by the Kariz–Islam Kala road. The rains in Persia and Afghanistan this spring were abnormally heavy, and as the road connecting the two frontier stations passes through a tract of marshy country, a delay at Kariz of several days was necessary. There is however a southerly track hugging a low range of hills which is, although with difficulty, passable at any time of the year. By this we eventually crossed from one country to the other, passing through a village sometimes called Hajjiabad and sometimes Farmanabad. From Islam Kala to Herat the road is easy and well made, the 80 miles taking about four hours. The entrance to Herat from this side passes by the famous minarets (*haft minar*) and the Musalla. An interesting feature of this road is a village, about halfway between the frontier and the town, in which Turkomans have been settled, still retaining their distinctive dress.



Mr. Sykes' route in northern Afghanistan

Monsieur Hackin noted in his paper to the Society (*Geogr. J.*, vol. 83, p. 353) that owing to the improvement of communications Herat could no longer be considered an isolated town. To some extent this change has been accomplished already since the opening of the Herat–Maimana–Mazar-i-Sharif road, and is evident from the great variety of peoples in the bazaar and the goods for sale. The bazaars are now undergoing a vigorous course of renovation, and although sentimentalists will always bewail the destruction of the old, a tribute cannot reasonably be withheld from the excellence of the new designs. As is the case with most new building of this kind in the East, the old arched roof has been abandoned. Without the walls a new town is in process of erection, extending from the ark in the direction of the Northern hills.

Few things are so surprising to the traveller from the direction of Meshed to Herat as the tile work on the ruins of the Musalla and the minarets. Both the shrine of the Imam Reza and the Herat remains contain work of the time of Shah Rukh, and both are descendants of one tradition, yet there is very little resemblance in their style, design, or colour-treatment. The ribbed dome of the Musalla, similar to the Balkh dome, is the first indication of the Central Asiatic influence discernible in nearly all important architecture in this country.

From Herat we set out on the Northern road leading to Turkistan: thus traversing the same route which Monsieur Hackin discussed in his paper, but the other way round. From Herat the road follows the new Hazarajat–Kabul road until the village of Pala Piri (13 miles), when it leaves the excellent metalled surface of the new construction, turning to the north-east. Presently it enters the valley of an unnamed tributary of the Hari Rud in which by the village of Karokh (29 miles) is found the famous and delightful shrine. The garden of the shrine in which the Christian is hospitably invited to spend the night contains magnificent avenues of cypress and plane trees. It is distinguished amongst other things by two trees growing closely together, and to pass through the narrow interval between them is humorously supposed to be a sign of virtue.

From Karokh the road continues in the river valley for 39 miles. The valley is rich in pasture, and it is common to see, besides flocks and cattle, droves of mares. Near the head the road turns due north and rapidly ascends to the summit of the pass. This pass is generally identified with that which crosses the Zarmast Kotal. This identification probably arises from the lax application of names locally. For the pass most suitable for wheeled and animal traffic crosses a point indicated as the Kabodi Kotal on maps lent to me by the Survey of India, and this point is about 13 miles east and 4 miles north of that accepted by the surveyors as the Zarmast. This pass however is usually called the Sauzak, but sometimes the Zarmast. My personal opinion is that Zarmast is a general term applied to the whole of this section of the Parapamisus range. At all events it is very loosely used, but the point generally marked *Tang-i-Zarmast* or *Zarmast Kotal* on the maps is not the pass by which the negotiable road crosses. Disliking to confuse the issue further I hate to record that I have also heard the Band-i-Turkistan referred to as the Zarmast.

The crossing of the pass is dramatic. On the southern slopes the range is bare, supporting nothing more luxurious than camel thorn; on the north it is covered with a jungle of lofty juniper trees. The rainfall is considerably more

on this side, as the lush greenery, suddenly come upon, makes evident. This change of country reminds any one who knows the Firuzkuh pass of the descent from the Iran plateau into the Caspian provinces. The change here is not so absolute but more sudden

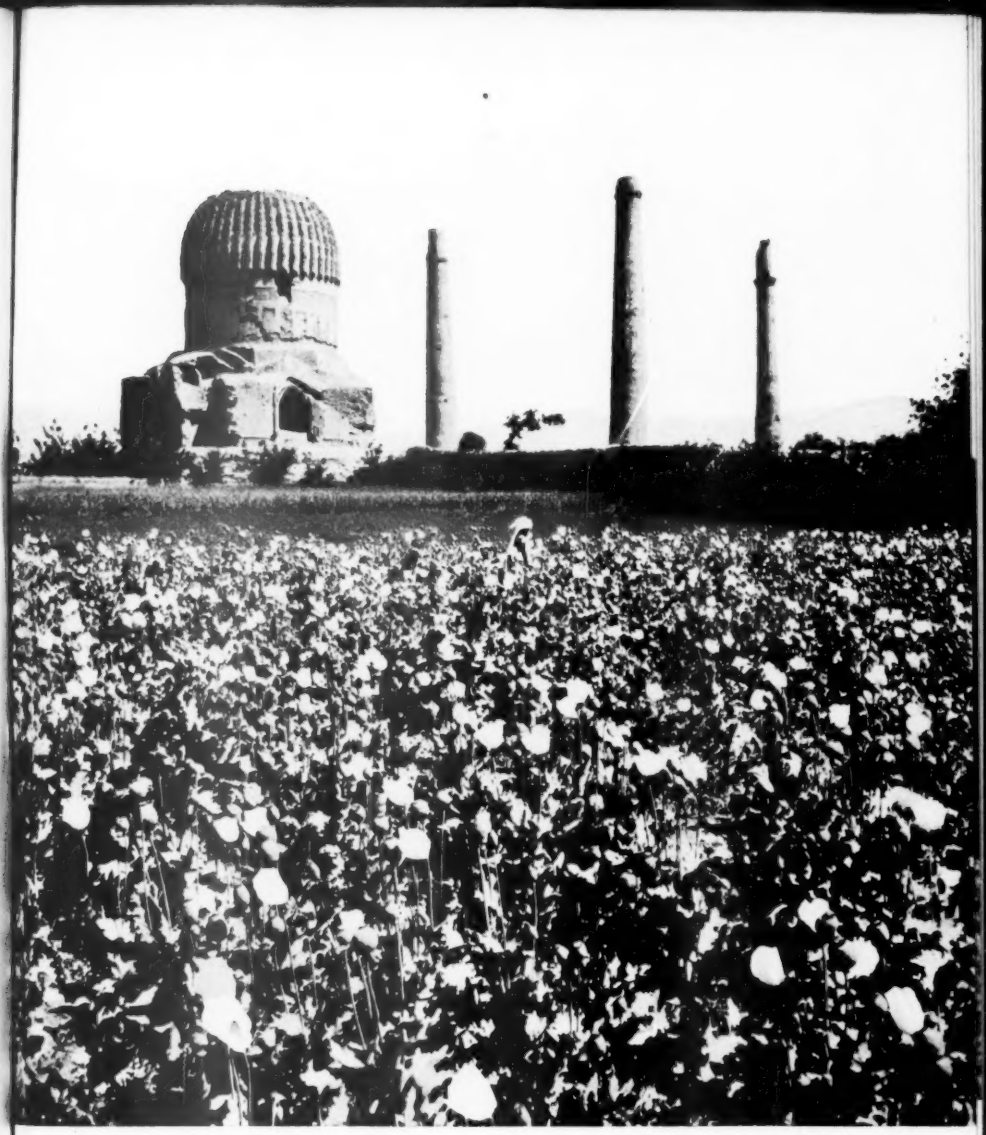
It is difficult, having only crossed in a season of abnormally heavy rainfall, to form any estimate of the road which now descends by a circuitous track from the plateau. It is certainly a piece of country in which the difficulties confronting an engineer are very great. The violent streams which a rainstorm bring raging down the precipitous gorges would cut up any but the finest structures. At the season in which we crossed it took us several hours to go not more than 15 miles. At the foot of the range is the village of Laman, a small dependency of Kala Nao, and I should like to take this opportunity to express my gratitude to the Governor of the latter place, who showed us friendliness and hospitality.

Having crossed the Band-i-Turkistan on horseback I cannot say how the motor road negotiates this range. The horse route, which takes the traveller through some of the most magnificent and loneliest country imaginable, pursues an independent course until it reaches the Murghab River, 20 miles from the town of Bala Murghab, at the bridge of Darband-i-Kilrekhta. Here the river flows through a narrow gorge fortified with towers popularly attributed to Alexander.

At Bala Murghab the change from the plateau to another country is first appreciated to the full. Although Afghans are still numerous the majority of the people are Turkomans and Usbegs. Here the predominating dress of the people is of the style associated with Turkistan: long flowered gowns, generally made of chintz imported from Russia, although the Bukharan stuffs are still quite common, and in place of the Afghan sandal, leather boots. The Usbegs and Tadjiks generally wear turbans with this dress, which is in general assumed also by the majority of Turkomans settled in the country; but in Bala Murghab, perhaps on account of its proximity to Russia whence there was reported to have been a recent flow of refugees, the Turkomans wear the large sheepswool busby. In Maimana, where according to the Governor's secretary many Turkomans are settled, the busby is never seen, and, on the same authority, the Turkomans sometimes wear the low cap bordered with fur, somewhat like the cap of Vladimir, also worn in some parts of Afghanistan by the Jews.

The country between Murghab and Maimana, a distance of about 110 miles, is uniform. The conformation is very singular: a kind of wold country consisting of small earth hills looking like a collection of barrows, and covered with rich pasture; wild barley and oats in abundance. As might be expected, the sheep and cows in this country produce very rich milk. The harvest richness of this corner of Turkistan immediately recalls the Transcaspian province of North-East Persia at Astarabad and Gumbad-i-Kabus—I suppose two of the richest natural corn soils in the world.

The road from Maimana to Andkhui continues through the same type of country, the hills growing less compact and the pasture more sparse. The village of Faizabad (25 miles), famed for its excellent water, marks the beginning of a less genial country, until, before Daulatabad, the country is bleak and dismal enough to call forth a period of "Arabia Deserta." Andkhui however



The five photographs are by **Robert Byron**

The Musalla at Herat: Mausoleum (c. 1430 A.D.) and three of the seven minarets

Putting out cured lambskins to dry on the roof of a caravanserai at Andkhui

derives its wealth from the harsh nature of the country where it is situated. The sheep pastures, productive of the *aarab* and the renowned *karakuli* skins, are such as to make the inexpert marvel that any beast could survive on so scanty nourishment. The closely curling wool of the *karakuli* seems to derive from a nourishment containing the very minimum of moisture, and one Usbeg shepherd with whom I spoke repeatedly pointed to the bareness of the downs, as if to furnish point to praise of his pasture. The flocks are owned for the most part by Usbegs or Turkomans who display a keen though not unfriendly rivalry. A short time ago most, or at any rate a large part, of the trade was in the hands of Jewish merchants, and this especially in Andkhui. The spirit of nationalism has of late affected commerce in this part of the world, and most of the Jewish merchants have been obliged to yield the trade to Afghans. Most of the Jews have, in consequence, left this part and migrated southwards to Herat. The most important skin markets are at Andkhui, Shibirgan, Akcha, and Mazar-i-Sharif, the most important being, on the authority of the merchants, Andkhui and Akcha.

A matter of astonishment to me was the high price of skins when, on the example of buying coal at the pit head, I wished to invest in this to us exotic and handsome article. The uniform demand both from those in the trade and not precluded the suspicion of a "try-on." The cost of a good lambskin was set at 80 Afghan rupees, of a faultless one at 100 Afghan rupees (approximately £2 10*s*.). Very few of the skins in the Andkhui market were under the former sum. When I urged the point that at such a rate every shepherd must be a millionaire, an Usbeg herdsman calmly replied that that was exactly the case.

While on this subject I should like to mention a theory for which I tried in vain while at Andkhui to discover support. Before starting on this journey I had been assured by a European agriculturist, living in South Persia, that the most important flocks had in former times been found near Bukhara; that the fame of these flocks was known to all herdsmen, and that the best flocks in all this corner of Turkistan were tupped by Bukharan rams. He had it further, on an authority which he respected, that most of these flocks had been destroyed during the Revolution, having been killed for meat, but that many of the rams, with sufficient ewes to continue the breed, had escaped the necessary massacre, and found shelter in Afghanistan. He had asked me to find what truth there was in this theory, but in interviews with herdsmen, merchants, and Government officials, I failed to discover evidence, and the name Bukhara when associated with sheep did not seem to stir any notable recognition. My own opinion and that of the Government officials whom I questioned is that the theory is fantastic, but I submit it to the Society on the chance that a reader may be able to supply the explanation.

From Andkhui to Balkh the road continues over the flat steppe land, sometimes desolate and sometimes green where the marsh land has been either drained for pasture or reclaimed and cultivated. At a small village named Khwaja Duka (81 miles) we saw a large drove of mares with a stallion grazing on what appeared to be a fine half-grass, half-corn pasture. Turkoman encampments are common until Akcha and easily recognized by the famous aspect of the *kebitka*. On several occasions we saw parties of Turkomans travelling, and the *kebitka* with its wooden doors, roof frame, and side posts,

together with the rush walls, is carried easily on two pack animals. The rapidity with which Turkomans can strike camp and start off is world-famous, and it does not seem beside the point to record here an observation made on the only occasion when I saw an exhibition of this feat.

The occasion was in 1931 at the Turkoman horse races in Persia when H.M. the Shah attended them at Bander Shah (formerly Bander Gez) on the Caspian. At the conclusion of the races, the Shah presented prizes to the winning jockeys. The assembled tribesmen numbered, at a rough computation, about two thousand. At the presentation every one was present. Then the Shah left. Five minutes after his departure all over the plain, even, it seemed, on the horizon, could be seen horsemen galloping away. All round the course there was a kind of storm of tents being taken down. Twenty minutes later only a few *kebitkas* were standing, and those were of the resident tribesmen, and in whatever direction one looked over the tremendous expanse of steppe one saw the same galloping figures, cartloads of tribesmen, and short rapidly moving caravans. By sunset, not more than a quarter of an hour later, there was no one to be seen except the few inhabitants of the immediate country.

In dry weather the journey from Andkhui to Mazar-i-Sharif can easily be done in one day. The distance is about 179 miles, and to Balkh 161 miles. Of the greatness of the sight when the latter city is first beheld with its long lines of destroyed ramparts it is difficult to convey an impression. Perhaps Marco Polo's terse reference best performs this office: "Balc is a noble city and a great, though it was much greater in former days. But the Tartars and other nations have greatly ravaged and destroyed it. There were formerly many fine palaces and buildings of marble, and the ruins of them still remain."

The mosque (the Masjid-i-Sabz) is now the only considerable building which decay has not left unrecognizable; of the Madrasseh the magnificent archway alone remains; at the western end of the town a battered ruin marks the site of the Masjid-i-Juma. The mosque has a ribbed or fluted dome similar to that of the Musalla at Herat, but the whole design of the building is of a different order, and to the uninitiated eye at least, suggests more powerfully than anything viewed hitherto the influence of Samarqand. Like so much Islamic building it suggests a devotion to façade at the expense of three dimensional proportions, but with an effect of clumsy concentration only relieved by a singular effect of the colour. Whereas in nearly all Persian tiled building the dominant blue is relieved of its steeliness by designs carried out on it in yellow, in this building the metallic quality of the blue is accentuated by whatever colour will raise it to silver; and as we saw it that evening standing out against a background of black thunder clouds, this effect was heightened to the strangest beauty. While at Balkh we met H.E. the Minister of the Interior, Muhammad Gul Khan, who was there supervising the laying out of plans for the reconstruction of main avenues. At the time of this visit the plans had not materialized in mortar and brick, but the Minister's work in Mazar-i-Sharif gives promise to the ancient city.

Balkh is separated from Mazar by 18 miles, and three roads, one direct, one *via* Baba Kohna and Deh Dadi, and one *via* Baba Kohna and Takhtapul, connect them. Mazar-i-Sharif has been greatly modernized of late: the western side is now taken up with the New Town. The most distinguished monument

is the shrine and tomb of Ali, a large blue-tiled mosque bearing three great domes surmounted by silver pinnacles. Although the mosque is a modern building the same treatment of the tiles extracting an effect of silver from the enhanced dominant blue suggests, however remotely, a connection with the Masjid-i-Sabz of Balkh. In all these towns in Turkistan it was impossible not to remark a certain *douceur de vie* most engaging. It is the custom in the evening for the inhabitants to repair to what we should term "the green," where bands, both brass and indigenous, discourse for several hours, and, at Maimana, the strength and youth of the town indulge in wrestling, gymnastics, and partridge fighting. In the latter sport, which is very popular, the cocks fight with natural weapons only.

For me one of the most interesting of surprises in Turkistan was to discover the great extent to which Persian is used as the language of everyday speech. This is all the more surprising to any one who has been in Persian Azerbaijan where, even in Tabriz, it is common to meet a man who only speaks Turki, and where half the people who speak Persian admix it strongly with Turki words and accents. Never in the bazaars of Mazar-i-Sharif did I find my own hideously ungrammatical rendering of Persian incomprehensible, nor did I ever find much difficulty in understanding. The Afghan pronunciation and use of words are full of divergence from classical standards, notably the use of *taklif* for "trouble" and such expressions as *ché gup* which would not be comprehensible in Persia, but it is interesting to note how much of the divergence is common to West Persian dialect: notably the pronunciation of *sh* as *s* and the degeneration of *f* into a vowel—Afghan often being pronounced *Awghan* and *ab* (water) becoming mysteriously familiar as *eau*. I was told that there is a movement at present to encourage the use of Pushtu in preference to Persian as the official language. One presumes that scholars would deplore this movement, and surely if the use of Persian as the universal tongue of the bazaars were to be dropped in this part of the world, there would be much cause for regret. I have it on the authority of the Vice-Consul of the U.S.S.R. in Mazar-i-Sharif that Persian is, though to a lesser extent perhaps, a common speech in the bazaars of Bukhara and even Samarqand. When it is considered that Baghdad and (presumably) Najaf and Karbala are virtually Persian-speaking towns, it is seen that a trader might pass thus from one extreme limit to the other of the Sassanid Empire and beyond, knowing only this one great language.

Those solemn clouds which had so enhanced the beauty of the Masjid-i-Sabz at Balkh were destined to play a considerable part in our future plans. A report soon found its way to Mazar-i-Sharif that the Wali of the province had been delayed at Haibak by a tremendous fall of rain involving landslides. The road, it was said, would be closed to motor traffic for some time. In the circumstances, disappointed in our hope of an excursion to the Oxus, we set about the task of hiring horses for the journey to Bamiyan and Kabul. Our arrangements were nearly completed when a lorry owner, Sayyid Jamal by name, an inhabitant of Khyber, brought the news that the journey south might be done by car: not by the Haibak road but by Kunduz and Khanabad. The opportunity, as it thus presented itself, of going farther east and seeing the province of Kataghan and possibly of Badakhshan was too good to be missed,

and it involved a remote chance of entering the Wakhan. A little regretfully we countermanded the horses and made a contract with Sayyid Jamal. Should any reader of this *Journal* ever find himself in Kabul anxious to do a journey, let me here recommend Sayyid Jamal as the most courageous driver and excellent companion whom it has been my fortune to travel with.

The road from Mazar-i-Sharif to Kunduz presents no difficulty, a great part of it being metalled. Between the town and Tashkurgan we encountered no object of especial interest except a lizard of size so vast (3 feet) as almost to make him a dragon. The town of Tashkurgan is 35 miles from Mazar-i-Sharif. According to the distances recorded on the reliable speedometer of the machine, the village of Abdan and the Shibkali Kotal should be placed about 5 miles west of the position they occupy on the maps lent to me. Fifty-five miles from Mazar-i-Sharif the road approaches the Shadian foothills, after which it enters a great plain before ascending the Band-i-Kataghan, which is first encountered at its foothills at the 84th mile. The pass which, from the Turkistan side, is no very grave matter, is 4 miles long. From the top a wonderful view comes into sight of the Kunduz plain, the dark green lines of the river marked heavily in the tawny colour of the plain, and beyond it the white heights of the Hindu Kush. The descent into Kataghan, a considerable drop, continues until a tributary of the Kunduz is reached 7 miles distant from the summit of the pass. Four miles farther on it meets the Kunduz river.

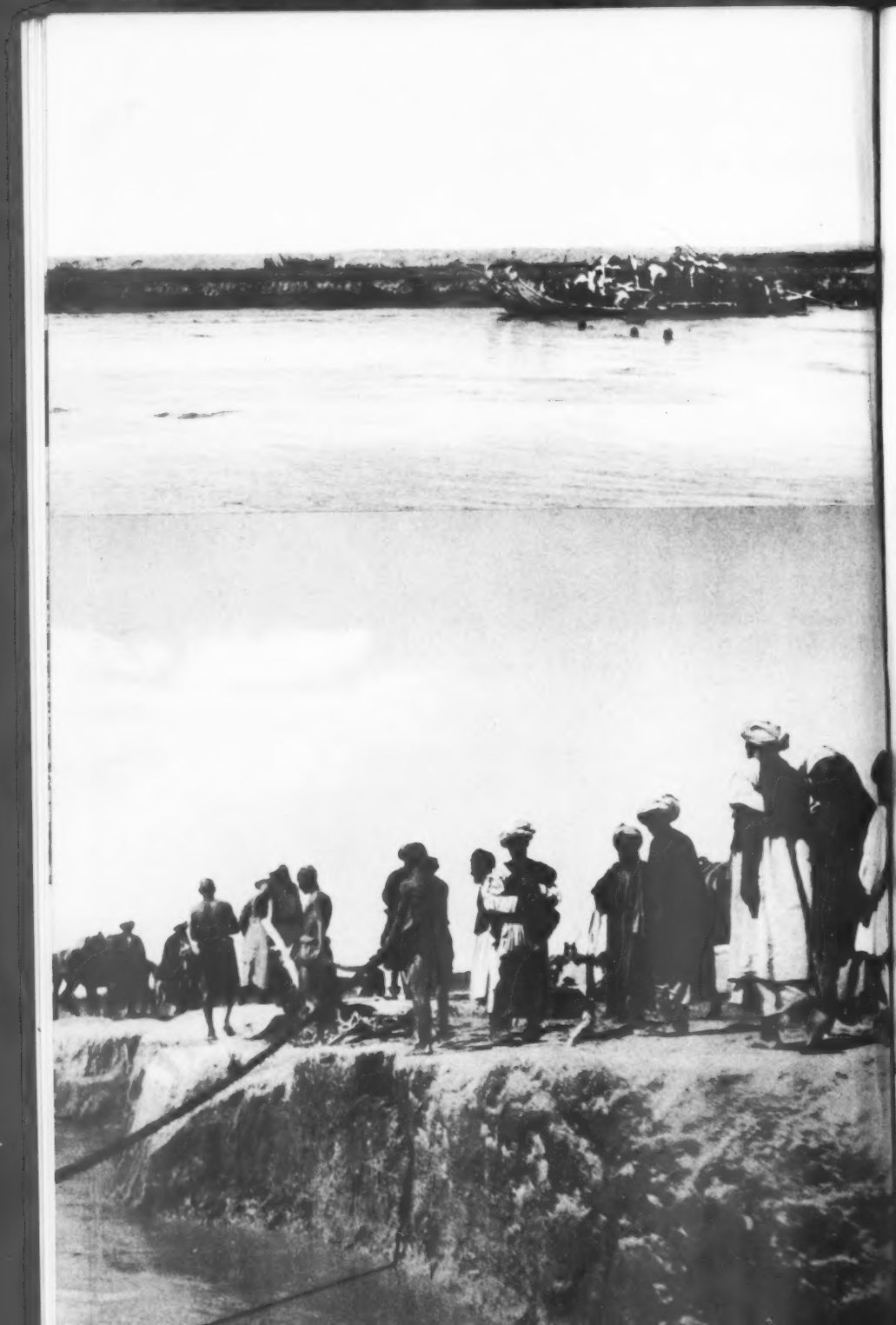
Up till the present no bridge has been built over the river, but a ferry meets the demands of lorry traffic, while horses are swum across with an expert swimmer to guide them. The rapidity of the stream is very great, and the embarking stage is about 100 yards upstream of the landing-stage although the breadth of the river is not more than fifty. Once the car or wagon is on board the ferry is left to the mercy of the river, which immediately carries it to mid-stream. Here the pilots dive into the water, and swimming with three limbs and holding a guiding rope with one hand, they bring it to harbour. The whole operation takes little time. Two miles from the river is the town of Kunduz. From here to Khanabad the road is difficult to follow. It passes through two river-beds, at the second of which it meets the Khanabad–Kabul road, having made a wide detour necessitated by the marshy lands west of the town.

Khanabad, like Kunduz, was formerly situated in a dismal tract of swamp land. An efficient system of drainage has now rendered the place healthy, as it has transformed Kunduz from an almost uninhabitable collection of hovels[1] to a productive agricultural locality. We were lodged in a delightful encampment which the hospitable Governor arranged for us in a tree garden. The trees were of the *chenar* order of plane, reminiscent of the gardens of Persia, but excelling all but the most sacred of plantations in soaring and magnificent stature. The surrounding fields grow corn and rice, and in scattered situations groups of a kind of asphodel. The latter, curiously enough, is not grown for ornament but for an excellent bread made from the crushed seeds.

The first 18 miles of the road south to Kabul is complicated by unbridged watercourses. These present no too serious impediment as they are seasonal only, and, though we travelled along this road at the most difficult time of year, we were able to outstrip the fastest horse with ease. The gravest obstacle was

[1] It is supposed that Moorcroft and Trebeck died of a fever contracted in the malarial swamps of Kunduz.

Kebitka tent at a Turkoman encampment between Andkhui and Akcha



a muddy flow, which we encountered 37 miles south of Khanabad. A storm somewhere to the south-east had been responsible, and the mysteriously rising and lowering water was never under the belly of a horse. After spending the night by the stream, in the hopes of it having subsided in the morning, we were appalled to find, in spite of a cloudless sky, that it had actually risen. The solution of the problem was simple. Although the road embankment through the stream had been washed away, the drivers of the collected lorries decided to plunge their machines in the water, drive down it about 60 feet, and turn up on to the opposite bank at a point where it rose more gently, though horribly steep enough. The manoeuvre was carried out with great dash and success. I mention this matter as illustrating the resourceful courage of drivers in this part of the country, a sovereign asset where the natural difficulties to road making might be so discouraging. Ten miles farther on the road meets the main village of the group named after the Baglan department. At the 53rd mile the road rejoins the valley of the Kunduz river, which it had previously followed for a mile, before leaving the Khanabad plain for some foothills 35 miles before. The river is followed until the road makes a short diversion of 5 miles to the east, crosses the magnificent old Pul-i-Khomri, and then returns west and south, meeting the main Mazar–Tashkurgan–Haibak road 8 miles beyond the bridge.

Three miles beyond the junction the ascent from the Ghuri plain to the Kampirak Pass begins. After winding about the foothills the road makes the latter part of the ascent on a fairly straight track which runs along a series of natural bridges or saddles. The pistachio line is passed 4 miles from the beginning of the ascent, and the summit is reached after 8 miles. At the time of the year (early June) when we crossed this pass, which might be taken as the bridge between the Iranian or Middle East and Central Asia, it may be soberly described as the most astounding landscape imaginable. The harsh crags over the snow-line, with their implication of the grimness of the plateau, dominate a scene of vast undulations covered with green grass and flowers, and distantly, lines of tree and field indicate the course of the Kunduz in the plain. On a clear day it must be possible to see almost as far as the Oxus, though the traveller would easily believe that he can see Samarqand itself in the vast scene.

On the northern side of the range the road descends moderately for 8 miles, when it enters a narrow and difficult defile, which I presume to be at the place marked "Amrutak Kotal," where it descends for 5 miles before meeting the Kunduz again. The river, which is now flowing due eastward, has changed its name to the Ghuri Rud. The road enters a valley between vast rock mountains, following the river upstream. The river is rejoined at the 100th mile, and the first considerable village is met at the 112th mile: Tala Barfak. In the spring this village is strangely desolate. It is the winter and summer habitation of herdsmen, but at the time of the spring grass and crops (the *bahari*) it is deserted except for a few ancients and a hospitable dispenser of tea.

Nineteen miles farther on the remains of the Sassanid foundation, the Castle of Barfak, stand on an eminence in the midst of a widening of the valley, and 6 miles beyond the road follows the river up into a series of gorges, which continue for a distance of approximately 48 miles. The most notable interruption in the series is the plain of Doab (149 miles from Khanabad).

The Kunduz ferry: (above) guided across the river by swimmers, (below) awaited by a crowd on the east bank

After the Kampirak pass, the long gowns of the Turkish fashion become rarer, until by Doab the people wear, almost to the exclusion of other dress, the loose draperies of Afghanistan proper. Two things are notable in this village—British petrol and glasses for tea in place of bowls. The latter is an interesting point. On the western side (that is, approaching Turkistan from Herat) the "region of the bowl" appears to begin at Kala Nao. In spite of the proximity of Russia, the bowl is preferred to the glass throughout Turkistan and Kataghan, and on this road is not ousted by glass until Doab. There probably is a faint hint of China, rather than a Persian survival, the venerable bowl having been discarded in Persia and the more Iranian part of Afghanistan. It would be interesting to know to what circumstance this marked preference is due.

From Shikari (179 miles from Khanabad) we turned off, on the new road, to Bamiyan. On rejoining the Mazar–Kabul road a day or two later, we followed the series of gorges for a few more miles until we left it for the ascent of the Shibar Pass, spending the night at an upland village (Sang-i-Shibar) where our escort entertained us to a concert of guitar and song. The elder of them declared the opinion that in India, Afghanistan, Persia, and England the music was of a high order—in other places it was bad. "But Russian singing," I urged. "Oh, it's rotten," he replied (*Bessya kharab! Bessya kharab!*).

The Shibar Pass, which marks the Oxus and Indus watershed, is reached by an easy ascent 4 miles beyond this village. Two miles farther on we were again delayed by the effects of the abnormal rains this year. For 17 miles the road was frequently blocked by mud slides, which the precipitous nature of the cliffs either side of the valley render a constant danger in the spring months. The road itself is admirably designed and has a very good metal surface. Such things as these constant mudslides provide typical illustration of the difficulties in face of which such excellent work in communications has been carried through by the Kabul Government. The bazaars of the villages, Chahar Deh (226 miles), Siah Gird (233 miles), and Charikar become rapidly larger and more cosmopolitan in their wares as the road nears the capital. The plain of Charikar is entered by an iron bridge, and as the traveller leaves the main Hindu Kush ranges and enters the Koh-i-Daman regions, he finds himself in the normal plateau landscape, which is here curiously reminiscent of the Zand valley between Isfahan and the Bakhtiari mountains.

We reached Kabul at the 297th mile. We had covered 930 miles from Herat, travelling in no hurry; and under perfect conditions this journey could probably be done in eight days. For the first part of the journey we were in a Chevrolet four-seater ("machine-i-sawari" is the newly coined word for such a vehicle) which broke down completely at a caravanserai named after the Moghor district 50 miles before Murghab. The fault of this car when used on these roads was a too low clearance. From Murghab to Maimana we travelled in a Ford car. The rest of the journey was done in Chevrolet lorries, which seem the ideal cars for this country, the clearance being sufficient, and the engines giving no trouble. In all we covered 1360 miles in Afghanistan, under unusually difficult conditions, and without any really grievous excess of trouble. Of this distance only 50 miles were covered by horse, which 50 miles, with all respect to progress, were very much the most delightful.

LIBYAN DESERT DUNES

H. J. L. BEADNELL

IN two of the most recent papers[1] on the Libyan Desert entirely contradictory views are expressed regarding the most fundamental point in any study of the great sand accumulations of the region, *i.e.* the direction of the prevailing winds and its relation to the orientation of the dune-belts. The great majority of previous observers were, I think, agreed that the general orientation of the belts within Egyptian territory is NNW. by SSE., and is the result of prevailing winds in the same direction. Two exceptions to the above statement must be noted. In Northern Sinai, and in the extreme south-west, near 'Uweinat, the lie of the dunes is not in conformity with the general NNW.–SSE. disposition.

As long ago as 1907–08 I carried out in the Oasis of Kharga, over a continuous period of twelve months, regular observations of the meteorological conditions and the relation of the latter to the disposition and movement of dunes.[2] Dr. Ladislas Kádár has now published the results of similar, though necessarily less detailed, observations during a period of six weeks, and his conclusions do not differ in any important respect from my own. "North winds," he writes, "are greatly prevailing (63 per cent.), and the direction of these north winds is identical with that of the dune rows. . . . Next to this in frequency is the south wind (14 per cent.), the direction of which is again identical with that of the dunes, though, as it is in counter direction to the former, it does not twist their course, but only stops and delays their procession. Besides these we mention only the north-west wind with its frequency of 10 per cent., but this does not differ much from the direction of the dunes. Of the strong winds north was 4 and north-west was 1; in this latitude I have not observed strong winds from any other direction. It is true that these facts are fruits of observations only a month and a half long, but they are still sufficient to reinforce the statements of my predecessors and to prove that the Libyan dunes are parallel with the prevailing wind."

Now for the opposing view. Captain Orde Wingate went from Dakhla to Abu Mungar, and thence slightly north of west for 220 kilometres, closing up near the end of his traverse with Mr. P. A. Clayton's dump, lat. 26° 54′ 32″, long. 25° 46′ 06″. Proceeding by camel transport he was able to examine with great care everything which came his way; and although his journey is modestly described as a failure—and was in so far as the discovery of the mythical, or, should I say, elusive Zerzura, and the bones of Cambyses' soldiers, are concerned—I think he carried out a very fine piece of work.

As the chart showing Captain Wingate's traverse indicates no less than thirty-eight lines of dune, all strictly parallel and disposed in the usual NNW. by SSE. manner, his remarks on the prevailing direction of the wind come rather as a surprise. He expresses doubts whether the so-called "seifs," or

[1] Lieut. Orde Wingate, "In Search of Zerzura," *Geogr. J.*, vol. 83, no. 4, April 1934. Dr. Ladislas Kádár, "A Study of the Sand Sea in the Libyan Desert," *Geogr. J.*, vol. 83, no. 6, June 1934.

[2] "The Sand Dunes of the Libyan Desert," *Geogr. J.*, vol. 35, 1910; 'An Egyptian Oasis,' John Murray, 1909.

lines of cascading dunes, are directionally as regular as claimed by previous observers—his own measurements showing variations from 152° to 170°—and mentions that they are generally found near the summits of the whaleback dunes (where these exist), but never quite coincide with the latter. Wingate refers to the tendency of the southern extremities to veer off to the east, a feature first brought to notice, I think, by Major Bagnold. But the point of particular interest lies in the following statement: "The prevailing wind in the sand sea is held, on good authority, to be in the direction of the dunes, *i.e.* 340°–160° true. My own experience is slight, but during the thirty-five days I spent among the sands, on five alone was the wind from this direction. The prevailing wind was almost due west with a tendency to south. Clayton, of the Desert Surveys, whose experience of these wastes is second to none, told me, as his considered opinion, that west was the prevailing wind. If this should prove to be the case it would seem to modify the existing theory of dune formation."

The fact that it is much easier to cross the dunes from west to east than in the reverse direction, owing to the steeper slopes being towards the east, is regarded by Wingate as evidence contributory to his view. He suggests that the difference between the direction of the superimposed lines of crested dunes and that of the underlying whalebacks is attributable to the comparative mobility of the former, combined with a change in the direction of the wind over a vast period of years. In addition he raises the question whether it is not possible that a radical change in the prevailing direction of the wind has taken place and that the disposition of the dunes to existing conditions is in process of adjustment.

I have studied Captain Wingate's paper carefully in order to weigh the exact data on which he bases his view—perhaps I should say suggestion—that the prevailing winds are from the west and that the longitudinal arrangement of the dune-belts is due to a wind-direction which no longer exists. In this connection one must keep in mind that the important winds are those of sufficient velocity to move sand across the open plains, *i.e.* winds of from approximately 23 m.p.h. upwards. The role of westerly winds below a moderate breeze (No. 4, Beaufort Scale) in shepherding the sand of the dunes, in being responsible for the more steeply inclined eastern slopes, and in causing the veering to the east of the lower terminal extremities of the "seifs," is, I think, not open to question. But such winds are only of secondary importance in the control of the general disposition of the dunes.

During thirty-five days spent by Wingate among the sands only on five did he record the wind as from the north. Unfortunately particulars of the direction on days when the velocity attained 23 m.p.h. and upwards are not stated. A lesser velocity really only means transference of sand from one slope of a dune to another. Above 23 m.p.h. the whole atmosphere becomes charged with driven sand, not only in the immediate neighbourhood of the dune-belts but over the adjoining plains as well, even where the latter are of rock, or are superficially composed of gravel "serir," and show few or no traces of blown sand in calm weather. During the same time of the year (February 1908) I recorded fifteen days of north wind, two days of south, and nine days of wind from various quarters. Of calm days there were only three.

And in no other month of that year (April 1907 to March 1908) was the figure for north and south winds so low, the monthly average for such being twenty-five.

Actually the only data I find in the paper relevant to the theory of a radical alteration in the direction of the dominant winds (*i.e.* a change from north or south to west) and a present-day adjustment of the dunes to the new direction, are as follows: (1) "the wind had veered round to 10° south of west, and wind-borne sand was tracing long pale lines across the surface of the desert"; (2) "during the night wind sprang up from the south-west and we awoke to find ourselves half buried in sand . . . the landscape was partially obscured by flying sand"; (3) "all this day the wind rose, veering to the south, and the flying sand stung the exposed portions of our bodies and obscured the landscape . . . the wind on these occasions was always south of west or due south"; (4) "a strong wind was blowing from the south-west and the sand was rising."

The above are the occasions mentioned when the wind was of the velocity of a moderate breeze, capable of raising and transporting sand, as distinct from rolling it up one slope of a dune and depositing it on the other. So that one may assume that, during the period in question, these were the winds which mattered, so far as the control of the general topography and lay-out of the dunes is concerned. But even overlooking the danger of drawing conclusions from so short a period, the data hardly seem to substantiate a claim for a change in direction from longitudinal, or north and south, to west. The significance of the south points on each of the occasions cannot be overlooked: (1) 10° *south* of west, (2) *south*-west, (3) on these occasions the wind was always *south*-west or due *south*, (4) *south*-west.

When one considers the obvious slewing round farther west and south-west of the winds normally prevailing in Egyptian territory, as is indicated by the disposition of the dunes to the north-west of Kufra, between 'Uweinat and Sarra, and to the south of the Gilf el Kebir, one might well expect to find an increase in the proportion of winds from west and south-west points in the region to the west of Dakhla and Farafra. And Wingate's observations tend to show that such is the case. But I remain unconvinced that such winds can be regarded as in any way dominant and that the disposition of the dunes is being readjusted to them. If westerly winds of a velocity of 23 m.p.h. became prevalent the whole topography of the dunes would, in my opinion, be completely altered in the space of a very few years.

Since studying in detail the dunes in the Kharga depression—an area which a critic of my views might not be disposed to regard as fairly representative of the Libyan Desert as a whole—I have examined many other dune-belts in different parts of the region, both in the north and in the south. Some of these lines of dunes are obviously anchored to topographical features; others are probably no less securely fixed at their points of origin by the general lie of the country, even though no obvious anchorages are noticeable. But always these belts convey to my mind an analogy to strips of bunting streaming in the wind from mast-heads. And nothing I have met with in the Libyan Desert (always excepting the dunes in a limited area of Egyptian territory to the south of the Gilf el Kebir and near 'Uweinat) has led me to modify the main inferences published as a result of an intensive study of the meteorological conditions obtaining in Kharga, and the relations of these to the dis-

position and movements of sand accumulations. The dominance of northerly and southerly winds as sand carriers, and the consequent extension of the dune-belts along longitudinal lines, seem to me conclusions which are amply verified by the orientation of the grooves of the sand-scored rock plateaux all over the region.

Captain Wingate discusses at some length the sporadic patches of soft sand, often indicated on the surface by the presence of coarse grains of purplish tint. It is remarked that these soft spots consist of mixtures of exceptionally large and exceptionally small grains, *i.e.* of two very unequal sizes only. Previous references to these remarkable accumulations are not mentioned, so it may be recalled that Bagnold drew attention[1] to their existence some years ago. Very aptly he described them as "liquid sands," into which, he remarked, one could plunge a 6-foot rod without effort. Bagnold's remarks on these sands seem to me very pertinent, and his explanation—that the lack of packing properties is due to the constancy in size of the grains—an entirely satisfactory one. Personally I have been familiar with these "pools of liquid sand" for many years. Motoring in the desert beyond Bir el Sahra (a new well sunk by me in 1927 west of Bir Terfawi), my wife and I on one occasion plunged headlong into one of these treacherous places, with the effect of a violent explosion. Since then I have regarded them as potential death-traps for solitary cars.

In the region west of Abu Mungar Wingate recognizes two types of sand and states that the cascading crests are invariably, and the underlying whalebacks generally, composed of the first type—a sand of very rounded yellow grains uniform in size. The second, underlying, type is described as composed of smaller whiter and less rounded grains—in fact, almost a white dust. This second type emerges, he says, from under the main dune and rolling-sand formations, but occurs mainly in flat expanses. It is suggested that the chief dune formations are an importation of later date and that they have been subjected to wind action to a greater extent.

Bagnold also notes two types, but remains, in my opinion, on safer ground in his generalizations: (1) Broad low whalebacks composed of grains of all sizes apparently arranged so that all interspaces are filled up; (2) chains of mobile cascading crests of fine grains.

Personally I doubt very much the reliability of Wingate's differentiation and suggestion that one type is a later importation than the other—except in a very temporary sense. The firm, flattened-out, and comparatively immobile whaleback dunes appear to me to represent the ultimate condition to which the material is reduced by the average winds of the region; while the mobile cascading crests are formed of the lighter material piled up and kept in active motion by the more powerful winds. If winds of the strength of a moderate breeze and upwards ceased within the region every chain of crested dunes would speedily disappear by being reduced to the second type. Transportation, with the piling up of the lighter portions, is the chief function of the powerful and prevailing longitudinal winds; levelling, mixing, and compacting that of winds from other quarters.

[1] "Journeys in the Libyan Desert, 1929 and 1930," *Geogr. J.*, vol. 78, no. 6, December 1931.

THE GEOGRAPHICAL CONGRESS AT WARSZAWA

A GENERAL Assembly of the International Geographical Union and an International Congress of Geography under its auspices were held at Warszawa from August 22–31 under the presidency of Dr. Isaiah Bowman, and with Professor Romer as the president and leading spirit of the Polish Organizing Committee. It will be remembered that at the meeting in Cambridge in 1928 Professor Romer had presented an invitation to Poland for 1931, but that the invitation of the French Government to Paris had then been preferred because of the great Exposition Coloniale which was to be held at Paris in that year. It was therefore a long-expected pleasure for geographers to find themselves at Warszawa in 1934, and the date happily coincided with the celebration of Professor Romer's fortieth anniversary in his professorship, marked by the presentation to him of a volume of papers contributed by many of his scientific colleagues and friends.

It is always a little difficult to keep a clear distinction between the acts of the General Assembly of the Union constituted by the official delegates of the adhering countries and of the Congress held under the auspices of the Union, to which all geographers are invited. Under the guidance of Dr. Bowman and of Professor de Martonne, the General Secretary, the distinction was on the whole better observed at Warszawa than it had been in previous years, and though it would be too much to say that only official delegates attended the General Assemblies of the Union on the afternoons of August 22 and 31, yet the business of the Union was kept clear from that of the Congress with considerable success. At the first General Assembly the report of the General Secretary referred to a certain financial stringency arising from depreciation of sterling in which the annual contributions had been fixed at Cambridge in 1928, and a Finance Commission was appointed to report upon the accounts of the past period and to make recommendations for the unit of future contributions. It was announced that three new states, Germany, Canada, and the Free City of Danzig, had adhered to the Union. On the motion for nomination of candidates as president for the ensuing period, Colonel Sir Charles Close was proposed, and there being no other nomination, it was unanimously agreed to recommend him to the second General Assembly for election. The Royal Dutch Government having invited the Union to meet next in Amsterdam, and there being no rival invitation, it was at the first assembly unanimously agreed to thank the Dutch Government and to accept the invitation, but it was left an open question whether the meeting should be in 1937 or 1938, there being considerable opinion in favour of a longer interval than three years, and a decision of the International Council of Scientific Unions allowing some latitude in the interpretation of the statutes which mention the term of three years as the normal interval.

The Congress opened on the morning of August 23 at a plenary session in the central hall of the Polytechnic School, and in the presence of the President of the Republic. After an address of welcome from the Minister of Education, Dr. Isaiah Bowman delivered his presidential address and was followed by brief addresses from six chosen representatives of the countries attending. On

the same afternoon the foreign delegates were received by the President in his presidential palace.

Following the pattern of the Congress at Paris, the work was divided into six sections, each meeting twice a day from 9.00 to 12.30 and from 16.00 to 18.00; and each evening generally at 18.00 there was a general discourse for the whole Congress. Local arrangements had been very thoroughly organized by the Polish Committee, and with the aid of a large staff sufficiently polyglot there was little difficulty in enjoying the large and varied programme of entertainment and excursions happily devised to lighten the scientific proceedings and yet so arranged as not to interrupt them. It was indeed an excellent feature of the Congress that the abundant hospitality did not as has sometimes happened rather curtail the serious business.

Before the meeting there had been organized excursions to the Pripet Marshes, to the Tatra, and to other geographically important regions of the country, and further excursions were arranged to follow the Congress. We hope, in due course, to give some account of these features. With the Congress itself we cannot hope to deal in detail. The six sections of cartography, of physical geography, of human geography, of prehistoric and historical geography, of regional geography, and of geographical education, were all well attended. A considerable number of the communications were already printed in a thick volume of abstracts, and the whole will be published eventually in one or more volumes. Thanks to the circulation of a preliminary programme suggesting topics for consideration, the papers read to the Congress were well grouped under suitable headings; and thanks perhaps to the occasional absence of geographers whose names appeared in the programme, the work of each session was on the whole completed punctually, with some time for discussion when the topic admitted. It must be said that there were some communications which might have been better studied in print than heard at the meetings; and an occasionally dogged resolution to read every word of a document actually distributed at the meeting was to be regretted. One may think that in course of time these Congresses will be devoted more to discussion and less to the hearing of formal communications; but those who have tried to organize Congresses in the past will be the first to admit that this is more easily proposed than realized.

In the section of cartography we should notice first an excellent account of the activities of the Military Geographical Institute of Poland given by its chief—Colonel Zieleniewski. When Poland became again a nation it inherited, of course, parts of the cartography of Germany, Russia, and Austria, and was faced with the problem of reducing three cartographies of diverse and unhomogeneous material to unity of figure, of triangulation, and of nomenclature. Colonel Zieleniewski gave an admirable account of the great work which had been accomplished in the few years since his Institute was founded. General Bošković had a somewhat similar story to tell of the topographical work in Yugoslavia. Professor Shokalski presented the plan of a hypsometric map of European territory of the Soviet Republic and the drawing of a physical map of the region surrounding the North Pole which the Arctic Institute hope to publish. Professor de Martonne displayed some sheets of a magnificent new atlas of France, Dr. Hermann Haack spoke of the project for an international

edition of Stieler's atlas, and Mr. Motilev of the programme for a great Soviet atlas of the world for which a special institute has been created in Moscow. Three sumptuous dummy volumes were produced to show the scale of the enterprise, and we gathered that the political maps would include some features unusual in an atlas. The compilation is said to be well advanced; but the estimate of publication next year is perhaps a little sanguine. Among other maps in prospect described to the section was our Society's Karakoram map with the outline, water, and contours complete, and patterns in watercolour for the hill shading. Colonel Schneider gave an interesting account of experiments preparatory to the proposed new map of Switzerland on the scale of 1/25,000; the Service Géographique de l'Armée showed some experimental drawings for the representation of mountain relief; while Colonel Fontanges of the same service presented his report of the Commission on Aerial Phototopography, which will require separate mention.

A principal and most valuable feature of the Congress was the International Exhibition of Official Cartography established in the fine drawing offices attached to the Polytechnic School. In his Preface to the catalogue of this Exhibition Professor Romer remarks that the first Geographical Congress was convoked in honour of the two celebrated cartographers Ortelius and Mercator, and that following this tradition successive pre-war Congresses included as one of their principal attractions exhibitions of maps, culminating in the exhibition of 1889 at Paris. The critical study of the maps of Europe then made by General Derrécagaix, published with the proceedings of this Congress, was of permanent value.

At the Congress of Paris in 1931 it was resolved that each official cartographical institute should report to successive Congresses on the progress of their map publication during the interval of three years, and it was decided by the Organizing Committee at Warszawa to enlarge this proposal by organizing an exhibition of Polish maps in three parts: an historical collection, an exhibition of current maps of the Military Geographical Institute, and an exhibition of recent Polish maps published by private institutions. These intentions were communicated to the President and Executive Committee of the Union and evoked a letter from Brig.-Gen. Winterbotham which proposed to organize an exhibition of the International 1 : 1,000,000 Map with its derivative map of the Roman Empire, and if it was agreeable to the Polish Committee a representative collection of Ordnance Survey maps of Great Britain. "This letter," says Professor Romer, "inspired the Polish Committee with the idea of organizing an International Committee of Official Cartography." They therefore, towards the middle of December 1933, appealed to all the official cartographical institutes, whether their countries belonged or not to the Geographical Union, and as a result of this appeal the exhibition at Warszawa showed the official maps of thirty-five countries: a remarkable testimony to the persuasive powers of Professor Romer and the organizing ability of Colonel Zieleniewski, Director of the Polish Military Geographical Institute, and of Colonel Lewakowski, who was responsible for the detailed organization.

The circular of invitation proposed that the exhibits should be of two kinds: first a series representing the official maps of the country, and secondly a series

showing the morphological and cultural types of landscape, to which a third section was added to illustrate the development of the standard map of the country by its successive editions. Not all the exhibits covered fully these three categories, but there were sufficient examples of the maps showing characteristic types of land forms and of "*démographie*" to form the basis for judgment of this new idea.

The circular invitation asked for specimens of the official cartography: "Un seul envoi," says Professor Romer, "constitue une brillante infraction aux réglements de l'exposition. Il s'agit de la splendide collection, envoyée par les États-Unis de l'Amérique du Nord. Cet envoi, préparé de longue date, nous avait été réservé comme surprise, et nous l'avons accepté avec la plus vive reconnaissance. Nous sommes persuadés que tous ceux qui visiteront l'exposition de la Cartographie Officielle, partageront nos sentiments de gratitude. Nous avons la ferme espérance que l'Exposition de Varsovie ne laissera pas d'influencer les Congrès futurs. Il n'est pas improbable que l'initiative des États-Unis n'indique le chemin à suivre aux expositions à venir. Au dernier moment d'autres pays, l'Allemagne, la Hongrie, l'Italie, la Suède, l'Union des Républiques Soviétiques, ont suivi les traces de l'Amérique et nous ont envoyé des collections que nous avons tâché de caser dans les conditions les plus favorables possible."

One may say at once that the surprise was not confined to the Polish Committee. A large part of the United States exhibit was contributed by the American Geographical Society of New York and the National Geographic Society of Washington. A smaller, though not unimportant part, of other exhibits was contributed by commercial firms of map makers and publishers of guide books. It is not altogether clear how the invitation to the official cartographical institutes of the various countries became extended to societies and commercial firms of some countries but not of others. There may well have been Geographical Societies and commercial map publishers who would have welcomed an opportunity of participating in this International Exhibition but were debarred by the form of invitation. If, as Professor Romer thinks, it is not improbable that the initiative of the United States points the way to be followed in future Exhibitions, it is desirable that the organizers of such Exhibitions shall take care to issue a wider invitation.

Inspection of the Exhibition as a whole did not reveal any striking novelty in method or design of topographical maps. Layer colouring was in most exhibits confined to the smaller scales and followed pretty closely the general colour scale of the international map as modified at the Paris Congress of 1913, with its violent transition from greens to browns without any of the intervening yellow which had been adopted in 1909 and abandoned in 1913 on the ground, we believe, that yellow inks of that epoch were fugitive. It may be well to consider whether the progress of dye-chemistry in twenty years has not made possible some reconsideration of that decision.

The most striking impression which one gained in examining this great collection was that in style of lettering and design of borders it represented the middle of the nineteenth century rather than the present epoch, one-third of the way through the twentieth. Only the Ordnance Survey of Great Britain has broken away from the style which seems to have been based upon printer's

types just at the epoch when printing types were worst. The great reform in typography of the last twenty years has not been accompanied by any reform in map drawing except in the new one-inch map of England, and it is high time that this question of lettering received the attention of other official cartographers. A thorough reform in map lettering may be advocated on two grounds: that the styles generally used are ugly and that they are illegible. Reformers will probably do well to concentrate upon the second; and we believe that if tests were made on a great number of existing maps, by many persons with varying powers of eyesight, a remarkable difference would be found between the legibility of the standard Roman and italic characters, and of alphabets designed on seventeenth-century models rather than on nineteenth.

We will consider only briefly the special selection of sheets to show land forms and demography or human geography. The most striking series of the first was shown by the United States Geological Survey to illustrate cycles of erosion, features carved from folded strata, features due to faults, volcanism, continental glaciation, Alpine glaciation, to solution, wind action, and other causes. Unfortunately it does not contain the reference letters and numbers of the sheets; but they can be identified by their names, and many schools of geography would find it useful to obtain the complete set of these sheets from the catalogue, mostly on the scale 1: 62,500 but some on larger and smaller scales.

The demographic or cultural interpretations placed upon selected sheets of topography maps are much more difficult to judge, but one may doubt the wisdom of exhibiting officially interpretations such as that affixed to the one-inch map of York and its neighbourhood which reads: "Typical Roman station —later cathedral centre—persisted as such—reintroduction of Christianity by Romans making for Roman centres. Focal centre of road system. First-class roads," or the comment upon the six-inch sheet including Piercebridge: "Piercebridge is an example of the square or 'laager' type of village. All the older buildings are round the rectangular green." It is improbable that any archaeologist would agree that York is a typical Roman station: on the contrary, we understand that in fact it was unique in being a legionary fortress on one side of the river and a civil town on the other. Whether the reintroduction of Christianity by Romans, whatever that may mean, made for York as a Roman centre seems to be questionable; and the term "focal centre" undesirable geometrically. The map suggests that Piercebridge is square because it is built inside a Roman fort. Such essays in interpretation may well be thought unsuitable for inclusion in an exhibition of official cartography, and it will be worth consideration whether, if the demographic section is maintained in future exhibitions, it should not be strictly separated from the cartographic and the morphological.

The exhibition of the published sheets of the International Map demonstrated afresh the great variations in its progress under different auspices with which the successive Annual Reports have made us familiar. Europe is now pretty well covered, in some cases by competing sheets designed to serve national rather than international purposes: that is to say, neglecting the fundamental principles that the International Map should show the spelling of place names proper to the territory represented. The very slight contribution

made officially by the United States is in striking contrast with the most important contribution made unofficially by the American Geographical Society in their map of Hispanic America, of which 50 sheets had been published in June 1934 out of the 102 sheets contemplated. We understand that the compilation of the remaining sheets is nearly complete and that funds for publication are, if not actually in sight, at least in prospect. The series will include new versions of the sheets of Brazil published by the Engineering Club of Rio de Janeiro some years ago, and it seems likely that the first continent to be completely covered by the International Map will be South America and that almost entirely by unofficial enterprise.

Among the maps of Europe the fine series of Finland on one in twenty, fifty, a hundred, two hundred, and four hundred thousand showed that her topographers are as ambitious as her geodesists. The Geodetic Institute of Denmark, which has charge also of the topography, showed beautiful sheets of the Faeroes and of Iceland. The Innsbruck sheet of the German *Uebersichtskarte von Mitteleuropa* had an attractive pink vertical hill-shading. The Briançon and Modane sheets of the new French 1/50,000 were striking, but had, if we mistake not, some washes of water-colour to improve the hill-shading. For study of land forms the Yugoslav 1/100,000 is especially useful, since it is published in two editions, the second with contours and water only. A good sheet to buy in the two editions is Novi Grad (1934).

The Russian exhibit was disappointing. We had heard much of enormous Soviet activity in topographical survey but not a single sheet of the standard topographical map was shown. There were a striking map of Novaya Zemlya published by the Polar Commission for the Academy of Sciences; the Index to a Hypsometric Map of Soviet Russia on the scale 1/1,500,000, to be layer-coloured, in ten sheets with names typed in Sans Serif (not Cyrillic); the drawing of an attractive physical map of the North Polar regions prepared by the Polar Commission of the U.S.S.R. under the direction of Shokalski; various soil maps, and an orographic map of the Caucasus of 1/800,000, with names in Georgian; but no indication of what we were anxious to see—the progress of the standard 1/100,000.

One may hope that some successor to General Derrécagaix has made a critical study of the whole exhibition at Warszawa, at more leisure than was possible to any one who even pretended to follow the proceedings of the Congress. With only a roughly annotated copy of the catalogue to assist memory it is hard to do relative justice to the display.

The exhibit of the Polish Military Cartographical Institute included specimens of their maps between 1/25,000 and 1/Million, of which we should mention particularly the sheet Tatry Wysokie of the 1/100,000 printed in six colours with fine reddish-brown contours at 20 metres and an effective purple hill shading, prepared specially for tourists in the Tatra. An excellent general map of Poland on 1/Million was presented to every member of the Congress. The Section of Historical Cartography included an interesting set of Russian, German, and Austrian sheets with their corresponding Polish provisional reprints. The Institute had also a first-rate exhibition to illustrate all the processes of map making from the geodetic triangulation to the production of the finished topographical sheet. In some ways the unofficial section was

the most interesting of all the Polish work, because it illustrated the debt which the country owes to Professor Romer and his Geographical Institute at Lwów. When Poland was reconstituted it had no atlases or books of geography in the Polish language, and it seems to be almost entirely due to Professor Romer that this necessary apparatus in elementary education has been provided with remarkable success and in the short period of about twelve years.

The Swiss Federal Surveys showed a very interesting series of pre-war projects for a new map on 1/100,000, and further essays in 1933 for a new version of the Carte Siegfried on 1/25,000 and 1/50,000. For the first time the larger scale will be extended over the mountains, by stereogrammetry from land stations, with contours at 20 metres in grey, black rock-drawing, and oblique hill-shading in a reddish-purple which has been chosen after many experiments, not for its beauty, but because it does not obscure the contours. These sheets are drawn on Bristol board or on coated paper mounted on aluminium, photo-etched on copper, and further engraved by hand.

The Ordnance Survey showed a very complete and careful selection of its standard maps, a magnificent drawing for the black plate of the new one-inch map of London, with a proof in full colour of the south-eastern section; specimens of the Land Utilisation Survey, the 1/M Population Map, the new Magnetic map, and other special sheets.

Of extra European sheets we may note the geomorphologic type sheets of the U.S. Geological Survey, contoured at very small intervals, down to 1 foot; the excellent maps of the Belgian Congo published by the Service Cartographique, Ministère des Colonies, Bruxelles; the four sheets of the 1/Million Map of the Roman Empire by the Survey of Egypt; and the extensive series shown by the Topographical Service of the Netherlands Indies.

Of maps from air-surveys there were few. Italy showed the cone of Etna on 1/5000 and several sheets on 1/25,000 by the Santoni stereogrammetric method; and Holland some large-scale revision by a new machine of which it would be interesting to have some description. The oculars extend so far forward that the sheet is plotted below them under the eye of the operator, and one would like to know what is the angular field of view in these long oculars. The U.S. Geological Survey showed reconnaissance surveys of Alaska from air photographs but without contours or spot heights. And two sheets of Trans-Jordan shown by the Geographical Section of the British General Staff were from air surveys by the Arundel method, though not so described in the catalogue. Apart from these there was little evidence of air-survey. The Swiss are relying on stereogrammetry from land stations, and an admirable Polish map of the Tatra National Park, on 1/20,000, with contours at 10 metres, was also apparently by this method.

Because of the international exhibition of maps, cartography was especially prominent in the Congress, and those who attempted to devote much of their time to this Exhibition saw little of other sections. For this reason the present notice is largely concerned with maps. We have been promised an account of other sections of the Congress for the November *Journal*.

At the second plenary assembly of the Union on the afternoon of August 31 Sir Charles Close was unanimously elected President of the Union for the

ensuing period, and Professor de Martonne was re-elected General Secretary. The unit of contribution was, on the recommendation of the Finance Commission, fixed at 400 francs French, and the President and Executive Committee were given power to take whatever steps seemed advisable, if the French franc should depart from its present value in gold.

The foreign delegates of the Union and members of the Congress will have taken away from Warszawa a grateful memory of the hospitality with which they were received and of the strength and energy with which Poland has worked during the last ten years to build up a modern state from the devastated fragments which were left to it after the war and the Bolshevik invasion. The brilliant receptions by the President of the Council of State and the authorities of the city of Warszawa, and the banquet given by the Organizing Committee, were supplemented by much friendly less formal hospitality of the Polish General Staff, the ladies' committee, and many scientific institutions. The Congress was received in the new building devoted to the National Library and held its last meeting in the newly reconstructed palace of the Academy of Sciences. Those who came by sea to Gdynia saw the development of a great new port side by side with the gardens of what aspires to be the Polish Riviera—an excellent example of town planning. On every side there was evidence of an ardent ambition to make Poland a first-class state and of considerable progress towards that end. It was in every way a most instructive visit, and the Union and Congress did not fail by their resolutions in the closing sessions to express their grateful thanks to the President and Government of the Republic and to the Polish National Committee for all that had been done to make the meeting a scientific success and an enjoyable experience.

REVIEWS

EUROPE

THE ROMAN WALL IN SCOTLAND. By Sir GEORGE MACDONALD. Second Edition. *Oxford: The Clarendon Press* 1934. 10×6½ *inches;* xvi+492 *pages; illustrations and maps.* 30*s*

The author's book on the Roman Wall in Scotland first appeared in 1911, but since then the number of forts excavated has been more than doubled and much new information gained, so that the true course of the wall from Forth to Clyde is now described for the first time. This second edition, virtually a new book, supersedes the first, and though here and there fresh discoveries will probably be made, must in future rank as the standard work on the subject. Both general reader and specialist have been considered, and the supply of illustrations—eighty plates and fifty-seven illustrations in the text—is most generous and helpful. We may take it that the main facts are now definitely fixed. Excavation has corroborated the statement of Tacitus that Agricola built a line of forts between Forth and Clyde, and that some sixty years later the soldiers of Antoninus Pius used the same sites. Some of the garrisons consisted of only "a handful of men," others were ten times as large. Of the road connecting the Agricolan forts "there is as yet no certain trace," though the Antonine Military Way may preserve its line. The Agricolan forts were occupied but a short time. For the new and stronger Antonine frontier larger and more substantial forts were built, and a stone-based vallum with ditch in front drawn right across the isthmus. The line was selected with great skill so as to command the country immediately in front, the chain of fortified observation posts communicating with one another by fire signals. This *limes*, a symbol of the power of Rome, "contemplated peace not war," discouraged petty raiders, and was a vivid warning to all approaching from the north. Its symbolical meaning had more value than has often been supposed.

The remains, especially numerous inscriptions recovered, are made to tell the story of A.D. 142, how the frontier was built by legionary soldiers advancing from east to west, and how, when it was built, some of them remained for garrison duty to supplement the auxiliary regiments. The troops were not withdrawn from Hadrian's Wall, but a double line substituted for a single one. For the man power available this policy proved an excessive responsibility, and it failed when fatal pressure came from the south-west. Though the forts were twice laid in ruins, Rome held on for forty years. The barrier was finally evacuated about A.D. 185: it is probable that the Romans themselves wrecked the buildings and burnt their stores before retiring, and that the Caledonians allowed the forts to crumble into ruins.

Such is the story in brief. This work treats not only of the actual remains—the line of the rampart, ditch, and Military Way recorded in great detail from field to field, the forts, minor structures, inscriptions, pottery, coins, etc., but gives the subject a solid setting in three introductory chapters reviewing the literary tradition of the Wall, the organization of the Roman army, and Roman frontier policy. Forts have been excavated at different times by different hands. Of the reports on them we have here a trustworthy synthesis, along with corrections and readjustments made possible by knowledge gained since the reports were made. The treatment is exhaustive, clear even when most technical, and cautious. The technical value of these pages is great: there are few excavators who would not gain many hints from the details of sections through ditch and

rampart and trenches in the forts. We should have welcomed a brief appendix for the benefit of those who can give to the Wall only a two-or-three-days' motor-car pilgrimage, with a selection of points which are at once particularly interesting and most easily reached, and with references to pages to be studied prior to the tour. With such a word from Sir George a brief visit could be made with absolute confidence. We gather, though not from the book, that the only part kept open for inspection is Rough Castle, but that parts of the rampart and ditch are very impressive. S. E. W.

FROM OLYMPUS TO THE STYX. By F. L. and PRUDENCE LUCAS. *London: Cassell & Co.* 1934. $7\frac{1}{2} \times 5$ *inches;* xii + 364 *pages; illustrations and map.* 12*s* 6*d*

This book contains a comprehensive summary of the history and legend of Greece connected by a narrative of the rather trivial incidents of a journey to the principal places of interest. Many of the tales are told well and not without humour, but the occasional gibes at certain modern institutions, dictatorships, diplomacy, and Americans in general, and at Baedeker's Guide in particular, are in doubtful taste. The authors state, on p. 102, that "this is no Baedeker"; but the best that can be said for their book is that it is a good informal guide (though its value as such is reduced by the absence of an index) to the historical and legendary associations of Greece, which would be an interesting companion for a visitor to Greece who is a good linguist. Although the authors thoughtfully provide English versions of most of the quotations from Greek and Latin verse which are liberally sprinkled through their pages, they also include plenty of quotations from French and Italian authors. The reader who does not know Greece will find this book rather heavy, and the descriptions of food and lodging will not encourage him to visit that country.

THE NATIVE'S RETURN: an American Immigrant visits Yugoslavia and discovers his Old Country. By LOUIS ADAMIC. *London: Victor Gollancz* 1934. $9 \times 5\frac{1}{2}$ *inches;* 374 *pages; illustrations.* 12*s* 6*d*

The author of 'The Native's Return' left the country of his birth, Carniola, shortly before the outbreak of the Great War and emigrated to the United States of America where he spent the next nineteen years of his life, becoming a naturalized American citizen and marrying an American wife. As an author he won a scholarship which enabled him to revisit his former home, now incorporated in the Kingdom of Yugoslavia. His knowledge of the language and the contacts which he was able to establish through his family and through his repute as a writer enabled him to witness intimate scenes in the life of the Yugoslav peasants, to meet politicians, soldiers, and men of letters, and to be received in audience by H.M. King Alexander. His fluent narrative deals with many aspects of life in each of the component parts of Yugoslavia, and there is sufficient history to explain the present geographical composition of the Kingdom and the aims and aspirations of the King and of his people.

Mr. Adamic is at his best when he describes the life, customs, and costumes of the peasants, and the picturesque detail which he gives in Parts I and II of his book makes these sections admirable records of contemporary life in an interesting country.

In Part III the author's political sympathies, which have been hinted at in the earlier pages of the book, are more clearly defined. He contrasts Belgrade before the War and now, and he quotes some of the men whom he met in the capital in order to show that the present government, guided by the King-Dictator, is corrupt, not representative of the people of Yugoslavia as a whole, and pursuing a policy which is likely to lead to ruin or revolt. He points out that the Serbs hold

most of the key positions and that the Slovenes and Croats are seldom able to attain eminence. According to Mr. Adamic, the Western Powers, including England, are supporting the "economic-political-military ruling class of Belgrade" and are exploiting the native workmen for their own imperialistic ends.

Gradually Mr. Adamic found that his journey, which had begun with such enthusiasm for the country and native inhabitants, was likely to lead him into difficulties with the authorities who were beginning to suspect that his book on Yugoslavia might not be favourable to the present régime. As soon therefore as he had been received in audience by the King he hastened to leave the country with the notes for his book, the concluding chapters of which fully justify the authorities' suspicions. Mr. Adamic's observations are nevertheless interesting, although every one will not share his belief that the countries of South-Eastern Europe will find salvation in the direction of Russia, that there will be a new European war within three years, and that "America will have to go Left."

THE PYRENEES: French and Spanish. By E. ALLISON PEERS. (The Kitbag Travel Books.) *London: George G. Harrap & Co.* 1932. $6\frac{1}{2} \times 4\frac{1}{2}$ *inches; 270 pages; illustrations and map.* 7*s* 6*d*

This excellent and comprehensive little book is the best of the Kitbag series we have seen. To Professor Allison Peers the Pyrenees have long been a natural playground and a temptation to turn aside on his way to Spain, and he writes of them with an infectious enthusiasm, a firm grip on his subject, and a method that is as orderly as it is helpful. He has certainly given us, as he hoped, "a 'play' book which attempts to be a pleasant companion and not merely an informative one." He tackles the French Pyrenees from Biarritz, following the great Route des Pyrénées from west to east. We are glad to find him preferring Luchon to Cauterets. The chapter connecting the two, if we may so put it, shows the Professor's style at its best in the descriptions of the three cols crossed during the day's drive. Not only does he touch on all the French places of interest, but he describes a number of walks and excursions. He also gives us sections upon the roads and the new railways from Paris by Oloron to Jaca and through Ax-les-Thermes and Pugicerdá to Ripoll. A sense of duty made him divide his book equally between France and Spain, but we could find it in our hearts to wish that he had been less conscientious and given more space to the Spanish side, which is so much less known. As there is no great motor road, the mountains in Spain must be reached by the valleys. He would gladly have described all the valleys of his acquaintance, but has been obliged to confine his attention to the most important. He is alive to the weaknesses of the Spanish villages, giving a black mark to several for their pre-eminence in dirt, though for not a few he has only praise. He likes to think of peaceful Broto just on the other side of tourist-haunted Gavarnie; and there is the almost self-sufficing Valle de Arán, "shut in between high mountains on the east and west, a tariff wall on the north, and the inexorable snows on the south." L. C.-M.

TYROLEAN SUMMER. By OWEN HAMILTON. *London: Williams and Norgate* 1934. $7\frac{1}{2} \times 5$ *inches; 320 pages; illustrations.* 8*s* 6*d*

Mr. Hamilton has added to the numerous books on the Austrian Tyrol, one written from an unusual point of view. For six months he lived, so far as it is possible for a foreigner, as one of the villagers of Mieders in the Stubai valley, working with them in the fields, and sharing in their pleasures. His impressions thus gathered are on the whole enthusiastic, though he is not blind to their faults, which are those commonly alleged against peasants. They, on their part, appear to have accepted him readily enough, and finally to have approved of

him sufficiently to invite him to attend with their rifle company a festival in Vienna.

It is a pleasant, almost an idyllic picture that he paints, and to scan it will add to the enjoyment of the casual visitor to this hardly spoilt valley. Interspersed among these sketches are passages of a more general character, in which he has tried "to pin-point my impressions with a poet's eye." To one reader at least these rather sentimentalized attempts at profundity detracted from enjoyment of the book. There are one or two slips. The Fulpmes foundries produce steel, not copper; the retreat of the glacier does not justify the gibe at "clever scientists." There are also, somewhat surprisingly, a number of mistakes in German, corrected in an errata slip. G. R. C.

ASIA

COMMUNICATIONS IN THE FAR EAST. By FREDERICK VINCENT DE FELLNER. *London: P. S. King & Son* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* viii+362 *pages; diagrams and sketch-map.* 15*s*

This is a useful condensation of information to be found in a variety of works of reference upon communications in Japan and her possessions (amongst which, presumably, Manchuria is now to be classified), China, and Siam. It is well arranged, tersely written, and, as far as can be judged, reliable, though not without mistakes. For instance the Pearl River of South China is said to have "no importance from the point of view of hinterland because its short course serves a relatively small area only," a remark which scarcely does justice to the fact that it has an affluent in the West River. One feels a little doubtful, too, whether a specialist upon the subject of the Suez Canal would be entirely satisfied with that chapter. Broadly speaking however the book, which is obviously the result of careful work, is a serviceable compilation which should save a good many people a good deal of trouble. It is not intended, of course, for the general reader and few specialists are likely to devour it at a sitting. E. M. G.

RED ROAD THROUGH ASIA: a Journey by the Arctic Ocean to Siberia, Central Asia, and Armenia. By BOSWORTH GOLDMAN. *London: Methuen & Co.* 1934. $9 \times 5\frac{1}{2}$ *inches;* xii+278 *pages; illustrations and map.* 12*s* 6*d*

This is a valuable and interesting book. It can be said without hesitation that it is the best traveller's account of conditions in Siberia and Russian Central Asia published in English since the Revolution.

The author started out with certain qualifications which eased his way among the rough and varied types with whom he was in contact from the day he left England. An ex-naval officer and air-pilot with a knowledge of Russian already acquired by some months' residence in that country, he was able to make himself useful as one of the ship's company on the twenty-four days' voyage out from the mouth of the Tyne to the mouth of the Yenisei. His membership of a British Trade Union (he does not state which), his competence in the language, and his adventurous, if somewhat aggressive, personality, made it possible for him to make his way alone, with very little money and—during the latter part of the journey—in a weak state of health, through the continuous petty difficulties and almost incredible discomforts of a route, the whole of which has probably not been covered by any Englishman since the Revolution. Leaving his ship, and the trading convoy to which it was attached, at Igarka, the author travelled by river-steamer up the Yenisei to Yeniseisk, and from there by the Trans-Siberian Railway to Novo-Sibirsk, whence he followed the much-advertised Turk-Sib Railway to its junction with the Orenburg–Tashkent line north-east of the latter

city. From Tashkent he proceeded *via* Samarqand and Bukhara to Krasnovodsk on the Caspian, and thence to Batum, after visiting Tiflis and Erivan *en route*. Such a journey is not dangerous in the accepted meaning of that word, but the squalor and uncertainty of the travelling conditions all along the route constitute a very real menace to health (which the author was not altogether fortunate in escaping), and any one who has experienced any part of the route may well congratulate him on an achievement particularly creditable at the age of twenty-three.

The book, although it gives an excellent account of political and social conditions, does not pretend to be a contribution to geographical knowledge. At the same time the author gives much valuable information with regard to the development of the Arctic route by the Soviet Government, and it is interesting to note that such development as has taken place in Northern Siberia during the last seventeen years is in fact a tardy execution of plans already initiated by the late Imperial Government. Igarka, the new lumber-port on the Yenisei, has a rapidly growing population, which is swollen during the summer months by the itinerant labour attracted there. Yeniseisk, the old centre of the fur and gold industries, which Nansen found before the war already in decline, is now almost in ruins, and the population has fallen from a pre-war figure of about 12,000 to 6000 at the present time. On the other hand, Novo-Sibirsk is stated by the author to have a population of 250,000 (p. 138), and to be rapidly expanding. The policy of the Soviet Government towards the Samoyeds and Tunguses appears to be, on the whole, a responsible one, and efforts have been made to check the damaging traffic in drink. The same cannot be said for their policy towards the Central Asian nomads, which appears to be oppressive, and destructive of the whole fabric of their very specialized social structure.

The most interesting chapter from the point of view of political geography is that which deals with the much-advertised Turk–Sib Railway. Here again the author points out that the Soviets have only partially carried out plans which were far advanced under the despised "capitalist system" of the Tsarist period. The track, particularly those parts recently constructed under the Five Year Plan, is in a very bad state, and the average speed of the "express train" on which the author travelled was 12 miles an hour. The railway has much potential importance in relation to the Dzungarian Gap, and possible developments in Mongolia and Sinkiang.

It is possibly ungracious to criticize a book which is so packed with interest, but the maps (identical ones pasted to the outer wrappers) are seriously defective and suitable only to the needs of the most casual reader. Such important places referred to in the text as Dzungaria, Uralsk, Ustport, Barnaul, Chimkent, and Frunze (Pishpek) are omitted, and Lake Baikal and Yakutsk are shown in quite a novel relation to Yeniseisk. It is highly desirable that authors should adopt as a regular practice the inclusion in their maps of all places mentioned by them in the text. W. E. D. A.

THE LIVING INDIA. By Lieut.-General Sir GEORGE MACMUNN. *London: G. Bell & Sons* 1934. 9 × 5½ *inches;* xii + 318 *pages; illustrations and map.* 15*s*

'The Living India' (sub-title, 'Its Romance and Realities') will be of some interest to those who are aware of the limitations of guide-books yet are not prepared to make a serious study of modern India. The author claims nothing more, and would probably not endorse his publishers' flamboyant eulogisms. His purpose clearly is to stimulate the idly curious, whose attention is a plant of tender growth and may be nourished by racy anecdote and pungent phrase. A liberal and, at times, excruciating licence of diction, grammar, and spelling is therefore part

of the general make-up, and the uncritical reader will not complain of lack of entertainment.

The book passes in rapid review the ancient history of India, the impact of Western civilizations, and ethnographic, religious, and social phenomena; passes on to the life and conditions of the Services; recounts, with obvious delight, the varied sports of the country; skates with agility over the thin ice of modern political and social problems; draws a vivid picture of regions with which the author is familiar; and ends with "dreams" which allow of widely divergent interpretations.

In the historical survey it is surprising to find the work of Warren Hastings dismissed in a sentence and Robert Clive not mentioned at all. Throughout the book, in fact, there is apparent an unevenness varying with the author's personal interest in his subject. Thus, in writing of military matters, or of sport, or of the beauties of Nature, he strides confidently upon the heights, in the best of training. Elsewhere the pace is not so sure, though shrewd comment and a very human understanding of other people's difficulties show that the pedestrian is in no danger of collapse. But the educated classes of India, and the implications of the White Paper, are an obvious embarrassment.

The eighteen illustrations from photographs are not particularly interesting, and the map would have a greater value if it showed the boundaries of Provinces and States. An adequate index is provided. H. R.

THROUGH DEEP DEFILES TO TIBETAN UPLANDS: the Travels of a Naturalist from the Irrawaddy to the Yangtse. By HERBERT STEVENS. *London: H. F. and G. Witherby* 1934. 9×5½ *inches; 250 pages; illustrations and sketch-maps.* 10*s* 6*d*

This book gives an account of an important journey partly through unexplored territory, made in 1928–29 in connection with the expedition organized by the Roosevelts and Mr. Suydam Cutting, about which a fuller account is given by those authors in 'Trailing the Giant Panda.' Mr. Stevens travelled from Burma through Tali Fu to Tatsienlu. Some important collecting was done in the unknown country south of Tatsienlu; again, the country more immediately round Tatsienlu was very thoroughly searched for specimens of natural history. The author in this part of his journey, and also later, had the great advantage of being accompanied by the Rev. J. H. Edgar, of the China Inland Mission. No more knowledgeable or pleasant companion could have been found than Mr. Edgar, who has so often placed his valuable time and vast local experience at the disposal of travellers. From Tatsienlu the author went to Muping, a place from which much zoological material was obtained during the latter part of last century by French missionaries; but the author found this portion of the country rather poor in material of interest. From Muping the route followed was *via* Kiating Fu, with a visit to the sacred mountain of Omeishan; thence to the Yangtse, and down that river through the gorges to Hankow, Shanghai, and civilization.

The book is chiefly one for the naturalist, but both the naturalist and the geographer would have derived more knowledge and pleasure had the book been furnished with a better map. That provided is totally inadequate. A journey of this importance with its wealth of scientific detail certainly demanded a clearer map on a larger scale. The extensive and valuable scientific notes, including lists of mammals, birds, butterflies, and plants seen and obtained, are happily put in footnotes, where they are available for those more technically interested than the general reader, who will therefore not be wearied with lists of Latin names in the text. It would have been easier to follow the route if dates

and place-names had been more frequently inserted in the text, though consultation of the itinerary, which is given as an appendix, will usually enable the reader who is desirous of details to satisfy himself. From a scientific point of view the value of the book would have been enhanced by the addition of lists in appendices of the specimens collected.

The constant fear of brigands testified to the disturbed state of the country to which readers of modern books on China are now quite accustomed. No unpleasant incidents in this respect had to be recorded and the author is to be congratulated on the successful transport of his collections, which must have required constant and anxious care. We must feel considerable difficulty in accepting the estimate that the loads of wood carried up Mount Omei exceed the well-authenticated loads of 400 lb. carried by the tea coolies on the Yachou–Tatsienlu route. F. M. B.

AFRICA

DIE BAFIA UND DIE KULTUR DER MITTELKAMERUN-BANTU. By GÜNTER TESSMANN. (Ergebnisse der 1913 vom Reichs-Kolonialamt ausgesandten völkerkundlichen Forschungsreise nach Kamerun. Bd. 1. Ergebnisse der Expedition zu den Bafia, 1914.) *Stuttgart: Strecker und Schröder* 1934. $10\frac{1}{2} \times 7$ *inches;* xii+270 *pages; illustrations and map. M.*23

Dr. Tessmann classes the Bafia (inhabiting an area of some 170 square kilometres between the Wuri and the Mbam: approximately 4° 45′ N. by 11° 15′ E.) as "Neubantu," but identical in culture, though not in language, with the Mittelkamerun, Bantu, Ponek, Omand, Banend, and two other small tribes; while the Bati, who are linguistically allied to the latter, differ from them in culture and more nearly resemble the Pangwe and Wute. These have hitherto been very little studied; the only material earlier than the present work consists of papers by some German officers published in the *Deutsches Kolonialblatt*, 1905 and 1911, and *Mitteilungen aus den deutschen Schutzgebieten*, 1901 and 1905. None of the names occur in Johnston's 'Comparative Study,' but "Indiki" (No. 235 of his Semi-Bantu languages) appears to be a subdivision of the Banend.

Linguistically, if the Bafia are really to be reckoned as Bantu, they would seem to be an extremely aberrant section of that family. Six of the noun-classes are quite recognizable: Dr. Tessmann gives eight, but, for no very convincing reason, he has divided the *li-ma* class (Bleck-Meinhof's 5–6) into two, and his *Tätigkeitsklasse*, with the prefixes *ke* and *be*, is difficult to identify unless as a variant of 7–8 (*ki-bi*), which here has the prefixes *c-* and *bi-*. The vocabulary would seem, on the whole, strikingly non-Bantu, though we have such clear coincidences as *le-fum*, "chief," with the plural *me-fum*, *ḍ-is*, "eye," plural *m-is*. The word for "human being" is, curiously, *m-um*, plural *b-um*, which is unlike the usual Bantu form, but suggests the common root for "male," *-ume*. The frequency of consonant-endings is noticeable. Dr. Tessmann's arrangement of the noun-classes is peculiar, but identical with that adopted by him for Pangwe. For the full understanding of this and other points a reference to his former work on that people (1913) and his paper, "Die Völker und Sprachen Kameruns," in *Petermanns Mitteilungen*, 1932, seem to be necessary.

The author, somewhat strangely, considers the Bafia to be a (comparatively) primitive tribe, and praises their unsophisticated outlook, so devoid of false modesty, which he ascribes to their "monistic view of life." This seems to mean that they recognize no dividing line between man and nature, between body and spirit, between good (in the sense commonly accepted by us) and evil. (It might be instructive, in this connection, to recall some remarks by Mr. Fortune, in the

recent Congress of Anthropological and Ethnological Sciences, on the conceptions of "good" and "bad" current among Melanesians.)

But everything recorded by Dr. Tessmann seems to indicate fragments of broken tribes, more or less isolated in the hill country, cut off from traditional associations and having degenerated—or in his view, progressed, from a former level. Thus the very peculiar substitutes for clothing (tegipudenda calculated rather to call attention than to conceal) have taken the place of bark-cloth coverings; the cult of the ancestral spirits, together with religious beliefs and traditions in general, is clearly in a state of decay, and the objects known as images of ancestors (*Ahnenbilder*, called *baba* or *nyole*) are incised boards, figured on Plate 25, Nos. 3–5, 8–12, rudimentary forms of what were once recognizable representations of the human figure. The state of society described on pp. 224 f. and incidentally referred to elsewhere, would seem to point rather to deep-seated corruption than to a state of "primitive simplicity." The difference between this and even the Kikuyu custom described by Dr. Leakey is obvious. The institution of the *mbuń* ("ornamental house"), pp. 67 f., is, so far as one knows, quite peculiar: such a miniature house, in good condition, is photographed on Plate XI. The chapter on Magic (pp. 186–217, especially the section dealing with the Elume cults) merits careful study: on a superficial view it has little in common with what has been published elsewhere. The material culture of the Bafia is in some respects well developed, especially as regards wood-carving, basketry, and pottery, and is very fully described and illustrated. The construction of the house, too, is both neat and ingenious, and belongs to a relatively advanced stage.

One wonders what impression of these people would result from a more lengthened and intensive study, such as is now being carried on by the American Mission. Dr. Tessmann resided among the Bafia not quite six weeks, when he was forced to retire to the coast. In Fernando Po, where he resided from May to November 1916, he was able to work with "various Bafia men"; how many, of what competence, or how they came there, is not stated. There are indications that the principal medium of communication was "Coast English." A. W.

IN THE LAND OF SHEBA. By Captain E. J. BARTLEET. *Birmingham: Cornish Brothers* 1934. 9×5½ *inches; 182 pages; illustrations and maps. 7s 6d*

The author of 'In the Land of Sheba' makes no claim to accuracy, and has thereby spared himself some criticism. The book tells the story of a mining engineer who travelled from England to Walega in Abyssinia to join the band of prospectors who are and have been for many years hopefully searching the mountains there for gold and platinum in sufficient quantities to repay an expensive outlay on mining machinery. For those who follow in his footsteps the book will be valuable, for the narrative describes with humour the adventures he met by the way. Captain Bartleet skates lightly over the obstacles he encountered, but when he writes of contemporary Abyssinian politics the ice does not always support him.

The transliteration of Amharic words is not easy and there is no quite satisfactory procedure, but there is no excuse for spelling the title of the Abyssinian Minister of Foreign Affairs in three different ways—Blotingater, Batingata, and Blatingater. The description of the finding of the Queen of Sheba's mines may not convince, but makes good reading. The statue of the Emperor Menelik II mentioned on p. 176 as being at the Addis Ababa Railway Station is actually in the big square in the centre of the Capital. That opposite the railway station is the heraldic Lion of Ethiopia, as the photograph opposite (perhaps the best of many good illustrations) shows. R. E. C.

CENTRAL AND SOUTH AMERICA

ATTENDING MARVELS: a Patagonian Journal. By GEORGE GAYLORD SIMPSON. *New York [and London]: The Macmillan Company* 1934. 9½×6 *inches;* xiv+296 *pages; illustrations and sketch-maps.* 12*s* 6*d*

This volume contains an account of a journey to Patagonia in search of fossils and derives its title from a quotation from Moby Dick: "All the attending marvels of a thousand Patagonian sights and sounds."

Dr. Simpson is one of the best known of the younger American palaeontologists, and is Assistant Curator of Vertebrate Palaeontology in the American Museum of Natural History in New York. He is specially interested in the early history of the mammals and has published several valuable accounts of his researches on this subject. In 1930–31 he was the leader of the Scarritt Patagonian Expedition of the American Museum of Natural History, and the present volume is a more or less popular account of his adventures in that most desolate and inhospitable country.

On his arrival at Buenos Aires he was fortunate (or unfortunate) enough to be an eye-witness of the revolution during which Dr. Irigoyen, the President, was deposed, and Dr. Simpson had several narrow escapes from stray bullets owing to his anxiety to see all that was going on. Subsequently he left Buenos Aires in an Argentine Government oil-tanker for Comodoro Rivadavia, on the Gulf of San Jorge, about halfway down the east coast of Patagonia. This is the centre of an extensive oilfield, most of which is worked by the Argentine Government. About 100 kilometres towards the interior are two large lakes—Lago Colhué-Huapi and Lago Musters—and it was in this district that Carlos Ameghino made some of his most sensational discoveries of fossil vertebrates which were subsequently named and described by his brother Florentino. Dr. Simpson and his assistant Mr. Coley proceeded to this region with a motor truck and camping outfit, thoroughly explored the country, and obtained a magnificent harvest of skulls and skeletons of late Secondary and early Tertiary mammals with which to enrich the collections of the American Museum. The scientific results of the expedition are now in the course of publication.

The present work however is more concerned with the general aspect of the country and its inhabitants. It is a desolate and cruel land, parched and dry, without trees and with little water, while a ruthless and nerve-racking wind blows incessantly from the Andes. Dotted here and there are sheep farms, miserable hovels inhabited by the *puesteros*. They are not a race, but have come from every corner of Europe and often by devious routes; in not a few of them, too, there flow some drops of aboriginal blood, deriving from the tall Tehuelches or the fierce unconquered Araucarians of the mountains.

Dr. Simpson has written a most attractive account of this recently settled and unattractive land, which we can strongly recommend to those interested in out-of-the-way corners of the world. It is illustrated by some photographs, mostly taken by the author himself. Unfortunately the map is not up to the high standard of the rest of the work. W. L. S.

THE DISCOVERY OF THE AMAZON, according to the Account of Friar Gaspar de Carvajal, and other Documents, as published with an Introduction by JOSÉ TORIBIO MEDINA. Translated from the Spanish by BERTRAM T. LEE. Edited by H. C. HEATON. *New York: American Geographical Society (Special Publication. No.* 17) 1934. 10×6½ *inches;* xiv+468 *pages.* $5

The greater part of this work is a translation of J. T. Medina's 'Descubrimiento del Rio de las Amazonas,' first published in a limited edition in 1894. The

"discovery" is the voyage of Francisco de Orellana in 1540–41, which demonstrated that the rivers of the eastern slopes of the Andes ultimately found their way to the sea by the river mouth of the Amazon or Marañon. Orellana's achievement is not as highly rated as it deserves to be, partly owing to the brevity of the accounts, and partly because, from the circumstances in which he left Pizarro, he has been designated a traitor. The most accessible account in English is Sir Clements Markham's translation of Herrera's brief version (Hakluyt Soc., No. 24, 1859), in the introduction to which he refers to Orellana's "base desertion." Sr. Medina printed many documents throwing light upon Orellana's life, and a little-known manuscript version of the narrative of Gaspar de Carvajal, a Dominican friar who was a member of the party, prefaced by a vigorous justification of Orellana's conduct. The editors of the present volume, in addition to translating the work and correcting numerous bibliographical errors, have added a translation of Oviedo's account.

Orellana, when leaving Pizarro to seek the river junction where the guides had said that food might be obtained, had promised to return within twelve days. They did not however reach Aparia until the ninth day, having descended 200 leagues, a distance much greater than had been anticipated. His men, weakened with illness and lack of food, were afterwards unanimous in their opinion that to have returned would have been impossible. Moreover, after the lapse of time necessary to collect food and to return, Orellana had no guarantee that he would find Pizarro where he had parted from him. His decision to continue down the river was reached after a just appreciation of the situation. Pizarro was naturally among those who charged his subordinate with desertion, in order to explain away as convincingly as possible his own failure.

This volume does much to vindicate Orellana's reputation: Carvajal's account, full of praise for his leader's resourcefulness and courage, is certainly weighty evidence in his favour. It is also an important contribution to the history of South American exploration. G. R. C.

GOLDEN YEARS ON THE PARAGUAY: a History of the Jesuit Missions from 1600 to 1767. By GEORGE O'NEILL, S.J. *London: Burns, Oates, and Washbourne* 1934. $7\frac{1}{2} \times 5$ *inches;* xii+276 *pages;* 5*s*

The establishment and destruction of the Jesuit "reductions," or missions, on the Paraguay is one of the most remarkable incidents in the history of Spanish America. In many respects the Jesuits in the seventeenth and eighteenth centuries were anticipating the modern policy of "segregation" for native races, in contrast to the exploitation and slavery which they suffered elsewhere in South America. Their policy was an attempt to carry out the aspirations voiced by Isabella of Castile at the time of the Discovery; nevertheless the experiment was doomed almost from the first. The failure arose, not from the opposition of the natives, large numbers of whom accepted the régime with little hesitation, but from the hostility of the Spaniards, officials and colonists, from the indecision and slowness of the administrative machine, hampered by distance from the centre of authority, and from the frequent incursions of Portuguese raiders from S. Paulo, whose cupidity was incited by unfounded rumours of great treasure.

Their chequered history is familiar to English readers from the work of Mr. Cunninghame Graham, which did much to counter the prejudiced judgment of Carlyle. It is here retold, amplified by the results of later research and from a naturally even more favourable point of view, by a member of their Order. The author has reason to be proud of the achievements of his predecessors, and especially of their work in opening up the central regions

of the continent, a work the extent and thoroughness of which has only lately been recognized. He relates clearly and enthusiastically the early labours and martyrdom of the missionaries, the foundations of the "reductions," their migrations before the raiding Portuguese, their sufferings at the hands of officials and upstarts, the calamity of the boundary settlement with Portugal, and the final ignominy of their expulsion. More might perhaps have been said of the actual life in the "reductions." It is difficult to realize the reasons for the strength of the hostility which the efforts of the Jesuits almost invariably encountered. A map would have been of great assistance to the reader.

G. R. C.

AUSTRALASIA AND PACIFIC

AN EMPTY LAND: Pioneers and Pioneering in Australia. By the Hon. Sir JOHN KIRWAN. *London: Eyre and Spottiswoode* 1934. 9 × 5½ *inches;* xii + 322 *pages; illustrations.* 15*s*

The State of Western Australia is indeed "an empty land" for the most part, and the arid country which covers some three-quarters of it must remain so, except for scattered and commonly unstable mining settlements. The compelling force of geographical conditions has concentrated nearly all the population of less than half a million in the south-western corner of the State. How to occupy effectively the more or less inhabitable coastal parts that lie within the tropical zone along the north-western coast is a baffling problem, the difficulties of which are only too apparent from this book. The cattle-rearing industry, the mainstay of the white settlers, is far from flourishing, and its prospects of competing with other areas in the world or even in Australia, whose climate is less uncertain and trying and which have readier means of communication with the great markets, are poor. Sir John Kirwan faces the difficulties squarely, but offers no satisfactory solution of them. His book is largely a song in praise of the pioneers who have ventured against climatic odds into these tropical lands, interspersed with interludes of historical narrative, of anecdote concerning West Australian characters, and of political reminiscences. In spite of its disjointed and at times irritatingly digressive form the book is readable and entertaining, though probably more so to West Australians than to the English reader for whom we are told in the preface it was prepared from a nucleus of newspaper and magazine articles.

E. W. S.

COBBERS: A Personal Record of a Journey . . . to Australia, Tasmania and some of the Reefs and Islands in the Coral Sea. By THOMAS WOOD. *London: Oxford University Press* 1934. 8½ × 5 *inches;* xiv + 256 *pages; illustrations and sketch-map.* 7*s* 6*d*

Amid the growing spate of general and generalizing books—descriptive, retrospective, psycho-analytic, romantic—about Australia the geographer turns with curiosity to one by a musician. What musicians thought and think about geography we do not know: what Dr. Wood thinks about it we may surmise, but in any case his book is of surprising interest and value to geographers. A musician, one supposes, is one from whom thought and feeling in intimate and sensitive accord compel expression in clear and beautiful form; there is something of the joyful compulsion of creation about this book. It is no mere "travelogue"; it is the expression of an acutely critical and sympathetic mind reflecting upon a vivid and enjoyable experience. Dr. Wood takes Australia and Australians—and his thoughts upon them—seriously, but he clothes his thoughts in a whimsical and almost quizzical style which continually bubbles over into fun. He carries us

forward on a stream of facts, fancies, and ideas which flows over rough stones of criticism smoothly and rounds awkward angles with skill.

About half the book is devoted to Western Australia: all considered he saw this State well—if by "State" we mean, paradoxically, the areally insignificant fraction where settlement is at present most concentrated. Here too the geographical value is highest: there is a freshness and directness which later on fades a little.

As regards facts, the author is disarming: "I have avoided statistics as much as I could. They do not appeal to me: they are soon out of date, and they look untidy. But I have tried to get my facts right"; and ". . . I could have described the glory of the wild flowers in Western Australia if I had seen them in the spring. But history . . . should deal with what did happen, and leave the field clear for brilliant sketches of what did not to the new school of biographers." So far as the reviewer has been able to test them, Dr. Wood's facts are right. Such deductions as he draws leave room for differences of opinion, but they are certainly interesting. More important is the indirect geographical value: the vivid reflection of real scenes and real life. The book is one which no one interested in Australia, and no student of Australian geography, can ignore.

There is a "map" of the "nursery-mediaeval" kind, with dotted route; some pleasing photographs, and an index. Printing and production are excellent and, save for one or two possible mis-spellings of native names, no misprints have been noticed. O. H. T. R.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

VERGLEICHENDE LÄNDERKUNDE. By ALFRED HETTNER. Vol. I. Die Erde—Land und Meer—Bau und Hauptfonnen des Festlandes. Vol. II. Die Landoberfläche. *Leipzig: B. G. Teubner* 1933 *and* 1934. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; illustrations and maps.* Vol. I, viii+222 *pages; RM.*7. Vol. II, viii+172 *pages; RM.*6.40

This is a well-written and clearly arranged work, scholarly in method and execution. The first volume covers the general introductory topics of Physical Geography and includes a brief treatment of Map Projections, Surveying, and Cartography, the origin of major relief features, and kindred geophysical and structural matters. It concludes with a short account of minerals and rocks and a useful summary of the leading structural features of the Continents. It is arranged throughout on a logical, perhaps an ultra-logical scheme, and is adequately, though not profusely, illustrated.

The main reflections left in the mind of the English reader by a perusal of this work are likely to centre round the curious persistence of "national" schools of thought in geographical text-books. Physical geography fortunately does not lend itself to political propaganda, and this is not what is implied by the above remark. It is clear however that the babel of European languages still divides the literature of the subject into separate sections, largely unconscious of one another. The present work is modernist in viewpoint, and up to date so far as Germanic sources are concerned. The conception of continental drift and its corollaries in the field of climatic variation are frankly, though not uncritically, treated; but references to the work of British, French, and American geomorphologists are comparatively few, and confined largely to the work of a past generation. There is no adequate treatment of radio-activity as a geomorphic factor and no mention of recent British work on the Ionosphere. Lapworth, as usual, gets scant justice as a pioneer in the study of mountain structures, and the recent developments of fact and opinion on the importance of eustatic movements of

sea-level in the formation of coral-reefs and the control of coastal- and river-erosion are largely ignored. The difficulty of securing a balanced presentation of many diverse views, often mutually incompatible, must be admitted, and in fairness it must be conceded that a general balance has been skilfully maintained. The book does not aim to be encyclopaedic in scope, and it contrives to maintain a readable quality, so often lacking in modern text-books.

One general matter calls for comment, since it applies not only to this work but to most kindred European writings. The wholly exceptional features of the Western Alps and their region are at present dominating our view of mountain-building too exclusively. It does not seem likely that they are in any real sense a typical mountain range: the apt characterization by Holmes of Mediterranean structures as the "Enigma Variations" of tectonics embodies a viewpoint much nearer to the truth. If so, their features should not be permitted to obscure from our structural panorama such other characteristic features as the imbrication of the North-West Highlands, also recorded in the Eastern Alps and elsewhere, nor the several other variants on the "mountain-theme" of which we now have ample and precise knowledge. A balanced view of terrestrial morphology must await the merging of local and regional peculiarities in a more general embodying scheme.

The second volume carries on the method and manner of the first. It treats in concise compass of erosional geomorphology, *i.e.* normal erosion, the work of ice, desert, landscapes, coasts, etc. The photographic illustrations are numerous and well chosen, though their reproduction leaves something to be desired. One notes with regret that little or no use is made of block-diagrams. While adequate explanation is given of the cyclical concept of Davis and his school, it is evident that German, no less than French, geographers view it with a certain lack of enthusiasm. Scant attention is paid to river development and to the fascinating records of "polycycle" landscapes. Herein lies a technique which bids fair to give a true scientific order and chronology to geomorphology, akin to that of stratigraphical geology. Whatever defects are inherent in the "Davis" viewpoint, it must at least be given credit for this important and stimulating body of ideas. Nevertheless it is valuable to have an alternative presentation of land-form study, for in part at least it fits the European scene better than do the American ideas.

A commendable feature is the clear and explicit treatment here given of the climatic control of land-form evolution. On the other hand the section dealing with glacial land-forms is disappointing. Garwood's convincing demonstration of the role of glacial protection still seems to "cut little ice" in Germany, though there has been ample time for its assimilation in the body of the science. Apart however from such minor defects, the second volume of this work is a sound and well-written introduction to the science of geomorphology. S. W. W.

CARTOGRAPHY

MONUMENTA CARTOGRAPHICA. Reproductions of unique and rare maps, plans and views in the actual size of the originals; accompanied by cartographical monographs edited by Dr. F. C. WIEDER. Volumes IV and V. *The Hague: Martinus Nijhoff* 1932–1933. 30 × 23 *inches;* 112.50 *guilders each volume*

These two volumes complete the first series of Dr. Wieder's great cartographical collection, the earlier volumes of which have been noticed from time to time in the *Journal*. Though they make no contribution to the history of geographical ideas, they are magnificent testimony to Dutch enterprise in the heyday of their

colonial expansion. The maps reproduced are drawn from two sources, to which he gives the names "Vingboons' Atlas," and "Secret Atlas" of the Dutch East India Company. The former consists of numerous manuscript maps, mostly dealing with the West Indies, which are now scattered among collections in Holland, Austria, and Italy, and which were first recognized as portions of a systematic work by Dr. Wieder. Of the draughtsman, Vingboons, who worked in the last quarter of the seventeenth century, nothing is known. As some of the maps are found in the unique augmented copy of Joan Blaeu's great atlas in eleven volumes, now at Vienna, Dr. Wieder surmised that Vingboons was employed by Blaeu.

Among the maps which Vingboons produced, copying older examples in the archives of the Dutch Company, many of which are now lost, or more recent surveys, are the first perspective plan of New York, *circa* 1660 (of which some account was given in the *Journal*, vol. 53 (1919), p. 278), a large-scale map in 56 double folio sheets of the spheres of Dutch interests in the Americas, and several maps of harbours and watering-places along the routes frequented by the Dutch.

The manuscript maps of the "Secret Atlas" are also found bound up with the eleven volume Blaeu atlas at Vienna. This copy was compiled by a wealthy Amsterdam solicitor, Laurens van der Hem, who died in 1678. He appears to have feared that the Dutch East India Company might resent his possession of these unpublished manuscript maps—hence the title "Secret Atlas" which has been given to them.

Of chief interest to English students are those concerned with the Dutch discoveries in Australia and the Pacific. Though not sensational, they confirm, and amplify in some details, our knowledge of that epoch. There is the copy, made about 1670, of the chart of the first landfall on the Australian coast. It will be remembered that this voyage was made by Jan Rosengein and Willem Jansz on the *Duyfien* in 1606, when they explored a portion of the west coast of Cape York Peninsula. Dr. Wieder identifies the features named on the chart, and concludes that the first landfall, "R. met het Bosch,' was Coen River. This cannot however be certain, for the features shown do not coincide with those of the modern chart of this low coast. It is also interesting to note that the new land is inscribed "Nova Guinea," though it is not definitely joined to that island. There is also a similar copy of the first chart of Arnhem Land, which is additional evidence of the discovery by the vessel of that name in 1623. On this chart the coast-lines of New Guinea and Cape York Peninsula are definitely joined. The consistency with which the early explorers failed to make the western entrance of Torres Strait renders it difficult to believe, as has been suggested, that the eastern coast of Australia was explored from this quarter before Cook's voyage.

Another interesting chart is that of the course of the *Zeehaen*, commanded by Gilsemans, the companion of Tasman on his great voyage. This suggests that Van Dieman's Land was sighted by Gilsemans, and not by Tasman, and Dr. Wieder suggests that a study of it will amend the accepted identifications of Tasman's nomenclature. Finally, there is a chart of New Zealand, similar to that in the Huydecoper MS.

It only remains to be said that these volumes are accompanied by very thorough introductions, notes on sources, and bibliographical details, which will demand the attention of all future students of Dutch cartography and exploration.

G. R. C.

THE MONTHLY RECORD

THE ACCIDENT TO MR. FUCHS' EXPEDITION ON LAKE RUDOLF

As briefly recorded in the daily papers, a serious accident has befallen Mr. Fuchs' Expedition on Lake Rudolf. The party had been working at first to the north and west of the lake, but towards the end of July they were encamped on the lake shore near Sirima opposite the South Island to which Mr. Fuchs, the leader, and Mr. Martin, the geologist and surveyor, went on July 25. A letter from Mr. Fuchs, dated August 13, relates that he stayed with Martin until the 28th, when he returned alone to the mainland, and the following day, according to plan, Dr. Dyson left for the island with food supplies, while Fuchs started on a journey to the south end of the lake.

On his return to the base at Sirima a man came in from the lake shore camp to say that nothing had been seen of those on the island since August 5, when there was a fire visible in the north bay. The camp had been moved from its first position on the island to a point farther north, which shows that Dr. Dyson had reached the island, since it would be impossible to put the camp at that point without the use of the boat in which he had travelled.

A code of signals had been arranged in case help were needed. They were to light three fires or to signal by Morse with a flash lamp, and they were due to return about August 5, when the whole party was to move north-east to meet the District Commissioner near the Huri Hills and to go on with him to Jibbissa.

When they did not return, Mr. Fuchs tried for two days to get into touch with them by firing shots, both by day and night, and at least on one occasion, when there was a dead calm, they should have heard these signals, but there was no reply. Had the boat drifted away leaving them stranded they would have been able to signal. Had the boat sunk soon after starting and had they swum back to the island they would not have been able to signal. Had the engine broken down on the voyage they might have drifted northwards with the prevailing wind. One or both might have been injured on the extremely treacherous fresh lavas of the island.

When they became definitely overdue Mr. Fuchs arranged for one, and then for another, aeroplane to come from Nairobi to make a search, and we are indebted to the Secretary of State for the Colonies for the dispatch from the Deputy-Governor of Kenya which describes this search by aeroplane. On August 18 a Wilson Airways aeroplane with Mr. Pearson as pilot and Mr. Fuchs and Mr. Cleland (of the Kenya Police) as observers, made a reconnaissance flight over Lake Rudolf and a thorough search of the whole of the South Island. The camp sites were located and were completely bare. As it was known that the two had considerable stores which they intended to take back with them and these stores were not visible on the camp sites, it seemed clear that they had left the island. The aeroplane crossed to the Turkana shore and travelled north nearly to the third degree of latitude, crossed again to the east shore and came south until opposite South Island. It then crossed the lake over the island to the western shore and travelled round the south end of the lake north to Sirima. No sign of the missing men or their boat or belongings was seen at any time.

On August 20 a further search with the second aeroplane was undertaken. From South Island a north-westerly course was steered to the Turkana shore and the search begun at a point at which it had been relinquished by the other machine on August 18. Flying at a height of about 10 feet they followed the shore to a point 10 miles north of Ferguson Gulf, but no traces of boat, equipment, or the missing men could be seen. The machine then proceeded to Central

Island without success, and from Central Island a course was made to South Island down the centre of the lake at a height of about 4000 feet, but there was no sign of any wreckage, petrol tins, or equipment.

The search of the shore was continuing, but it is unfortunately clear from Mr. Fuchs' telegram of September 4 that it was unsuccessful. Meanwhile, patrols by camel and on foot had searched both sides of the lake without result, and there is therefore little doubt that Dr. Dyson and Mr. Martin were lost by the sinking of their boat at some time which would have been soon after August 5, when their fire was last seen on the island.

We have at present no description of the boat except that it has been referred to as a collapsible boat and also as having an engine, presumably an outboard motor, and it was the only boat on the lake, which is subject to heavy squalls. Between August 6 and 13 there were two calm days on which the boat could have crossed from the island to the mainland, and the inference is that on other days the crossing would not have been safe.

The expedition had sailed from England at the end of 1933 and had been about seven months in the field. A letter from Mr. Fuchs dated April 4 gave the only account of its progress which had reached the Society until the recent bad news came. The surveyors had then been engaged in linking up the surveys of the Sudan, Kenya, and Uganda to the north and west of the lake, and by successful determinations of wireless longitudes had made important corrections to the hitherto accepted positions which dated mostly from before the days of wireless. The geology was described as very interesting in regard to tectonics, but otherwise dull, since the deposits, of which they had great hopes, proved disappointingly barren of fossils. They had made large collections in geology and botany, but had been hampered by long drought, which was afterwards broken, and subsequently by floods.

After their work at the south end of the lake they were intending to proceed north-east to study the branch of the Rift Valley which breaks away from the general line of the lake into Abyssinia. We can scarcely hope that this part of the work will now be possible, and the unhappy accident which has deprived the expedition of two of its members will also have made serious inroads upon their resources and their time. Nothing seems to have been left undone, either by the leader of the expedition or by the Government forces and the Wilson Airways Company, to make a thorough search as soon as the party were definitely overdue, and it is remarkable to read in the dispatches what powerful aid was available in this remote region. The wireless communication between the Government posts and the resources of the Wilson Airways Company made a thorough and exhaustive search almost immediately possible, and leaves little doubt that the disaster was due to a sudden accident to the boat.

GRIME'S DYKES NEAR LONDON

To the north-west of London are a number of dykes or ditches bearing the name of Grim or Grime, which is said to be the equivalent of Woden and of the Devil. In the *Antiquaries Journal* for July 1934 Dr. R. E. M. Wheeler, under the title of "London and the Grim's Ditches," considers the significance of these earthworks which intermittently line the Chilterns from Berkhamsted to Wallingford, though a well-preserved fragment of a much nearer one occurs near Harrow Weald Common in Middlesex. The dykes consist of a formidable bank and a ditch, invariably, save for a short extension across the Thames at Streatley, facing towards London, and appear to be the handiwork of people whose territory had to be marked off from the holders of the London district. They all agree in enclosing valley lands and in being built across clay soils just

beneath the crest line of ridges which on the far side slope to the London Basin. As settlement of heavily forested clayey valleys did not begin before Saxon times, and as a pagan origin is suggested by the name of the earthworks, their date is likely to be a little earlier than the seventh century A.D.

The governing motives of the whole series of dykes thus appear to be (1) a specific relationship to valley-land, and (2) a specific relationship to the London Basin. They constitute a series of boundary-ditches looking towards London and built by a population approaching from the north or north-west. The people were farmers exploiting the valleys and partially clearing the forested claylands in or about them. As a valley-folk they avoided the uplands especially those fringing the London Basin. The latter were occupied in the more fertile stretches by groups of farmers of different social tradition, and the dykes mark the points of impact. It is clear that the Grime's Dykes are not mere local hedgerows but represent a common political interest extending over a frontage of some 50 miles of country and defining traffic no less than tenure.

There is evidence that it was the territorial rights of Londoners in connection with the chase that prevented the people who built the dykes from advancing into the valleys any nearer to London than they did. Twelfth-century documents refer to "ancestral" hunting rights in Middlesex, Hertfordshire, "all Chiltern," and Kent "as far as the water of Cray." As regards this river it is significant that near Bexley there exists to-day a mile or more of dyke appropriately facing London and exactly similar to the Chiltern Grime's series. In Surrey, unfortunately, the rights of the mediaeval Londoners are less clearly defined, so that it is more difficult to bring the numerous dykes of that county into the present picture.

EARLY HISTORICAL GEOGRAPHY OF THE FENLANDS

Dr. H. C. Darby examines the part played by the Fenland in the Anglo-Saxon settlement of England in an article in *Antiquity* (June 1934), which carries farther back into history his study of the human geography of that area (*Geogr. J.* November 1932). At first the Wash and the Fens served as an entrance for the invaders, who advanced up the courses of the converging rivers. When however the small settlements gradually coalesced into larger units to form the states of the Heptarchy, the character of the Fenland changed: from being a high-road for immigrants it became an obstacle or frontier between the states. In Roman times the Fenland had been a grain-producing area, but by the eighth century it was an untilled waste. Centuries later Domesday Book records that its Hundreds were two to four times as large as those of the surrounding upland, indicating sparse settlement.

By their nature the Fenlands served as a barrier to military movement, whose impenetrability is evidenced by the frequent fighting which took place in the gap between marshland and forest to the south. There the Fleam Dyke, built to close this gap, marked the point of contact between East Anglia and Mercia. The avoidance of the Fenland was further strengthened by superstitious fears, of which there is much evidence in early literature, and which had some basis in the unhealthy conditions of life. The islands in this waste between two states thus became a refuge for the lawless and exiled, and perhaps for Britons or Welshmen. These bands would ravage the country of the neighbouring states, East Anglia, Mercia, and Northumbria, when opportunity offered, provoking the latter to extend their sway into the fens. Most of the south was controlled by East Anglia, with the Isle of Ely as the centre of a kind of administrative frontier province. To the north, the "eye" or island of the Lindisse (Lindsey) played a part similar to that of Ely in the south. On account of its isolation by the sea, the Fenland, and

the Axholme marshes, "Lindsey" appears to have had, after the Saxon invasions, its own line of kings, with a strong Celtic element. During the eighth century it passed backwards and forwards between Northumbria and Mercia, finally becoming a semi-independent appanage of Mercia. Dr. Darby therefore concludes that the Fenland of the Saxon period constituted a frontier as defined by Lord Curzon.

SMALL GLACIERS ON THE ZARDEH KUH

In an article contributed to the *Bollettino* (No. 14, 1934) of the Italian Glaciological Committee, a reprint of which we have received from the author, Professor A. Desio draws attention to the existence of small glaciers in the mountains of Western Persia, and describes four of them recently observed on a visit to the Zardeh Kuh in the Bakhtiari country. They have remained unnoticed probably because, owing to their small size, they are difficult to distinguish from neighbouring snow patches. The largest of those seen by Professor Desio he calls the Kulang-ci, from its position on the northern slopes of the peak of that name; it is of cirque type, with an area of about 70 hectares, its lowest point being at 4105 metres. A rather smaller glacier was observed north of the Ato Beki, and two much smaller (estimated area only 17 and 11 hectares) on peaks north of the Haft Panun. He was not able to determine any movement, but observed associated frontal moraines, and crevices upon the surface, which justify him in regarding them as small glaciers of the second order. The snow-line in this range may therefore be assumed to be about 4000 metres.

THE HOLY CARPET OF MECCA

The Society is indebted to Mr. Owen Tweedy for the interesting gift to the Museum of three pieces from the Holy Carpet of Mecca. They are beautiful specimens of the Egyptian covering for the Ka'ba and its gold band, which up to 1926 it had been the custom of the Government of Egypt to send annually to Mecca. Of the three specimens by far the rarest is the strip of black brocade from the main hanging which draped the walls of the Ka'ba on the occasion of the pilgrimage of 1920. We are informed by Mr. Tweedy that it was not usual for the King of the Hejaz to cut up the main hanging for gifts to his friends. The other two pieces are Koranic texts elaborately embroidered in gold and silver wire on black satin, which form the decorative band about 2 feet wide encircling the Ka'ba at about two-thirds of its height: one from the covering used at the pilgrimage of 1919, and the other from that of 1921. These have been mounted together and suitably framed and now hang on the wall on the west side of the Ambulatory.

OBITUARY

DR. MARION I. NEWBIGIN

The sudden death of Dr. Marion I. Newbigin, on July 20, was felt as a deep personal loss by a wide circle of her colleagues. Her ready sympathy and dry but delightful vein of humour, her wide range of knowledge, and her sound judgment will not easily be forgotten among geographers, nor will so gifted a personality easily be replaced. Up to the very last Dr. Newbigin was carrying on with her accustomed vigour what had lately been two principal aspects of her work, namely, her duties as External Examiner to the University of London, and as Editor of the *Scottish Geographical Magazine*. Like a majority of the older generation of English geographers, she came to the subject through one of the kindred sciences, in her case zoology. For some years she was assistant, and subsequently successor, to the late Sir J. Arthur Thomson as extra-mural lecturer in Zoology at the Women's Medical School in Edinburgh. Her book on 'Animal Geography' is well known, and she lectured on Plant and Animal Geography at Bedford College in the University of London. Her interest in the biological sciences gave a special flavour and a welcome objectivity to many of her books, such as 'Man and his Conquest of Nature,' 'Frequented Ways,' and the admirable little outline of 'Modern Geography' which she contributed to the Home University Library.

It was as long ago as 1902 that Miss Newbigin was appointed Editor of the *Scottish Geographical Magazine*, and in this work she was associated with Professor James Geikie, who was then Honorary Editor. She was brought at the same time into close touch with another famous Scottish contributor to Geographical Science, the late Sir John Murray, then President of the Royal Scottish Geographical Society. Under her editorship, the *Scottish Geographical Magazine* became a journal of first importance to serious students of geography, for they could be certain that the keen critical sense of the Editor would allow no material to find a place in its pages that was not well put together, well illustrated, and soundly based. They could count moreover on a note or comment on every new discovery or new work of importance. To the young geographer however the *Magazine* meant more than this. No matter if he were not a Scotsman or a member of the Society, if he had any real contribution to make to geography it was more than likely that it was in the *Scottish Geographical Magazine* that he first had the thrill of seeing himself in print. It is difficult to over-estimate the part which Dr. Newbigin played in encouraging original work in what is still a new and therefore difficult subject, and one in which the canons of sound scholarship are not yet established. She made it a practice to attend meetings of the British Association and kindred conferences, sitting through many long and wearisome sessions, in order to discover the newcomer of promise. The discovery was followed by an offer to print his paper, an offer frequently entailing upon herself arduous and meticulous work, since a beginner rarely knows how to revise and condense his work or to prepare it for press. As an editor she was severe, but it was a fruitful severity for the contributor ready to accept correction.

Ten years ago Dr. Newbigin received from the Royal Scottish Geographical Society the Livingstone Gold Medal in recognition of her services to Geography. Not the least of those services was the high standard of scholarship which she demanded of others and herself maintained in the subject to which she chose to devote herself.

E. G. R. T.

CORRESPONDENCE

BO GANG KAR OR MINYA KONKA

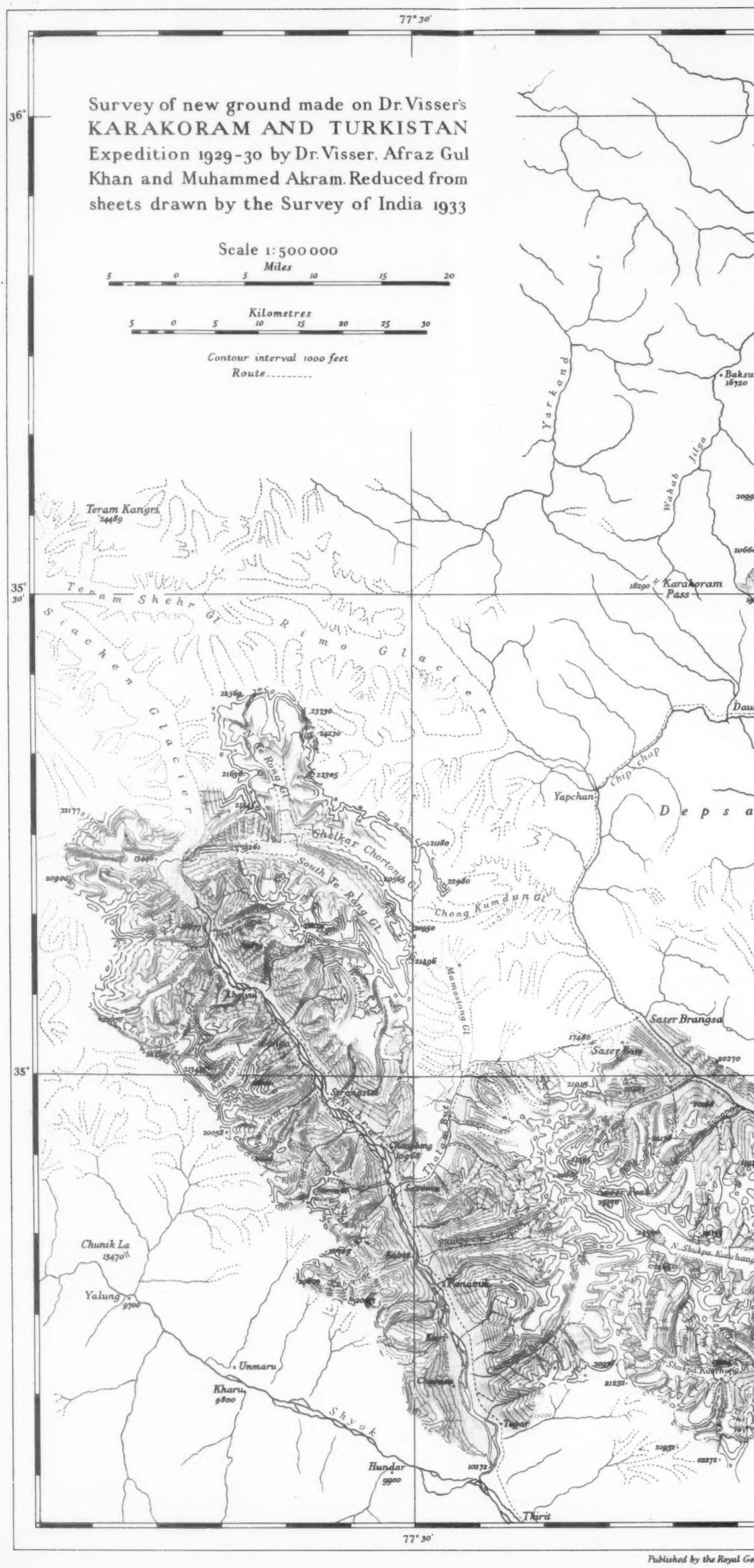
The title of Dr. Heim's book [reviewed in the *Journal* for June 1934, p. 519], 'Minya Gongkar,' is a much better approximation to the name of the mountain, Gangs d'Kar, than is Minya Konka, used by R. L. Burdsall in his article in the *Geographical Review* for January 1934. But Men-as Kun-gar, given as representing the transliteration of the Tibetan letters written by Dr. Heim's Tibetan, has no meaning in either Jäschke or Sarat Chandra Das; and "Kun gar," really "r'Kun gar," would mean "white thief" in an illiterate form. Certainly it in no way represents 'Minya Gongkar,' the name of Dr. Heim's book.

The statement in Burdsall's above-mentioned article that "Konka" is "pronounced somewhere between Gongka and Gungka" puzzles me, because "Konka" is not a name in use here, and the long Tibetan *a* is never between an *o* and a *u*. Again, it is not correct to associate, as he does, "revered," in the sense of "beloved," with my "Gangs d'Kar." The adjective properly defines the "Yul" (country or region) and not the peak or "Gangs." As regards the "a'Bang" its spelling and meaning are both uncertain, but as written for me it suggests an explanation of the local "Bo Kunka" heard by Kreitner, Gill, and other travellers, and closely resembles the name applied to the mountain to-day by the natives in its vicinity. The Chinese name is "Ko Kai Shan," evidently an effort to imitate "Gang Kar."

J. H. EDGAR

Tatsienlu. 8 *April* 1934.

Note by the Editor.—We would remind readers of the note by Mr. Edgar published in the *Journal* for September 1933, p. 264, in which he stated that "'Bang Gangs t'Kar' (pronounced 'Bo Gang Kar') is now as it was in Kreitner's day the local designation."


77° 30'
36°
35° 30'
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Survey of new ground made on Dr. Visser's
KARAKORAM AND TURKISTAN
Expedition 1929-30 by Dr. Visser, Afraz Gul Khan and Muhammed Akram. Reduced from sheets drawn by the Survey of India 1933
Scale 1:500 000
Miles
5 0 5 10 15 20
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Route.....
Yarkand
Baksu 16720
Wakab Jilga
Teram Kangri 24489
Teram Shehr Gl.
Rimo Glacier
Siachen Glacier
18290 Karakoram Pass
Chip Chap
Yapchan
Depsa
Shelkar Chorlonges
South Te Rang Gl.
Chong Kumdan Gl.
Monastang Gl.
Saser Brangsa
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Srinagar
Kargil
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Chushang 10900
Thaga La
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Yalung 9700
Unmaru
Kharu 9800
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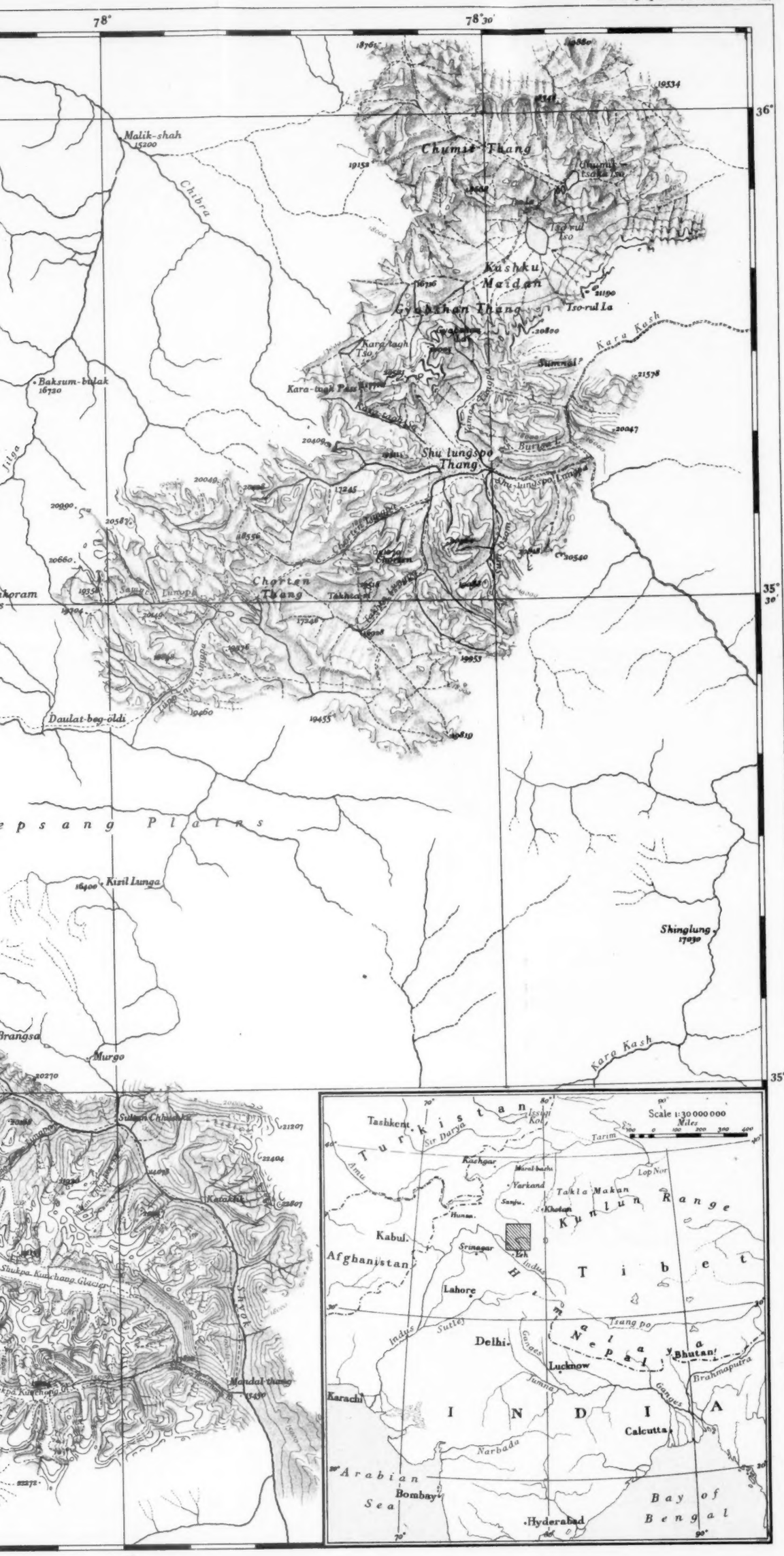

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KARAKORAM AND TURKISTAN
Visser